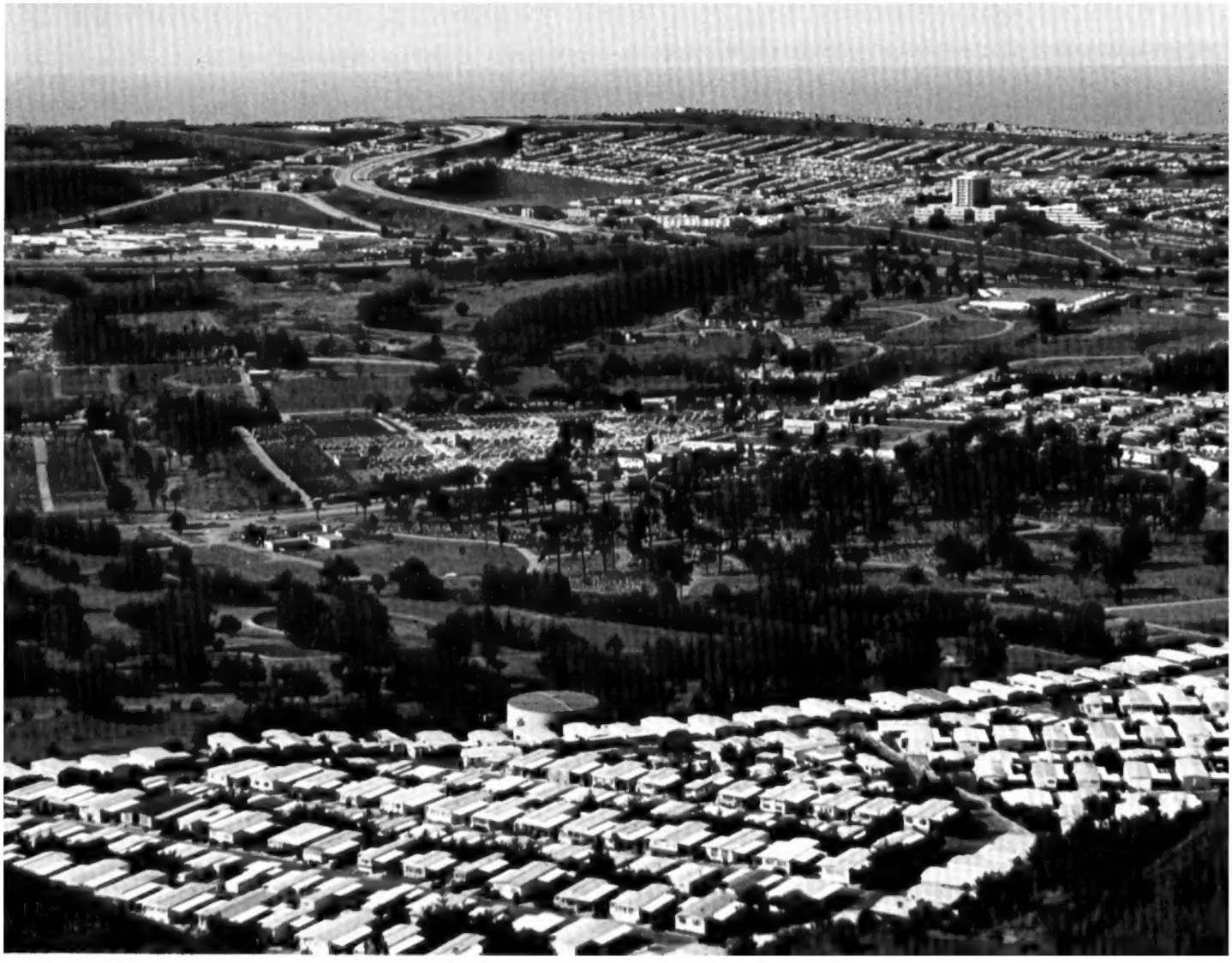
United States Department of Agriculture

Soil Conservation Service

In cooperation with the Regents of the University of California (Agricultural Experiment Station)

Soil Survey of San Mateo County, Eastern Part, and San Francisco County, California



How To Use This Soil Survey

General Soil Map

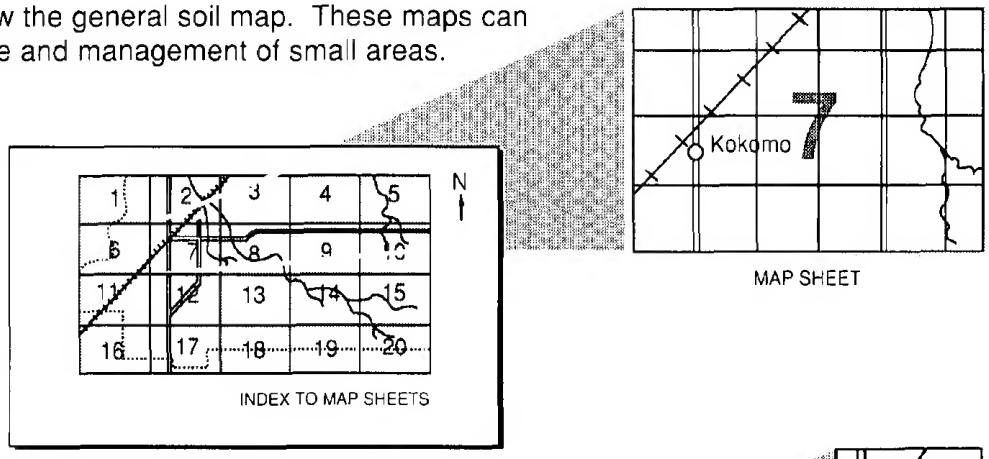
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

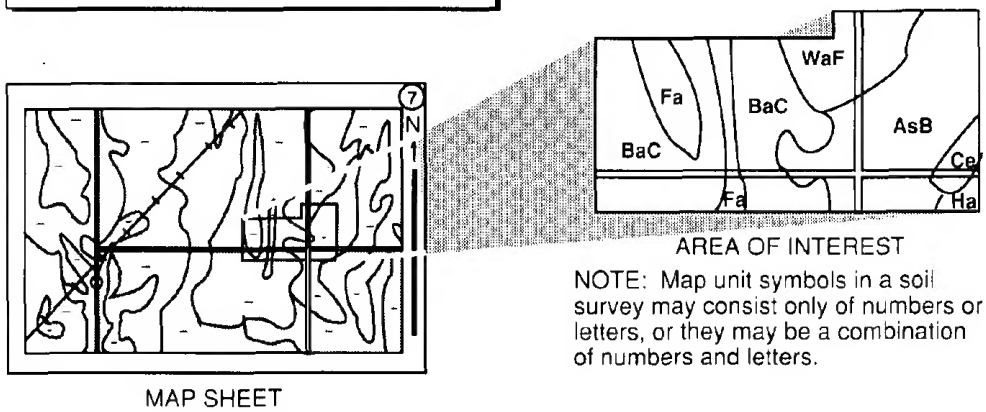
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

MAP SHEET

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1984. Soil names and descriptions were approved in 1985. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1985. This survey was made cooperatively by the Soil Conservation Service and the Regents of the University of California (Agricultural Experiment Station). It is part of the technical assistance furnished to the San Mateo County Resource Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: An example of urban development in the survey area.

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Issued May 1991

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in the survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Pearlie S. Reed
State Conservationist
Soil Conservation Service

Location of San Mateo and San Francisco Counties in California.

Soil Survey of San Mateo County, Eastern Part, and San Francisco County, California

By James H. Kashiwagi and Lisa A. Hokholt, Soil Conservation Service

Fieldwork by James H. Kashiwagi and Lisa A. Hokholt, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the Regents of the University of California (Agricultural Experiment Station)

SAN MATEO COUNTY, EASTERN PART, AND SAN FRANCISCO COUNTY are in the central coastal area of California. The survey area is part of the San Francisco drainage basin. It is bounded on the west by the Pacific Ocean and the Santa Cruz Range and on the east by San Francisco Bay. Santa Clara and Santa Cruz Counties lie to the south. The total land area of the survey area is about 150,460 acres, or 235 square miles. Elevation ranges from 2 feet below sea level to about 2,000 feet above sea level.

San Francisco County is mostly urbanized, and it includes the city of San Francisco. The eastern part of San Mateo County is also highly urbanized. Redwood City is the county seat of San Mateo County.

The San Andreas Fault dissects the county in a northwesterly direction, extending from Portola Valley to Mussel Rock. The soils west of the fault are used as watershed, wildlife habitat, and recreation areas and for urban development. The soils east of the fault are used mainly for urban development.

An older survey, "Reconnaissance Soil Survey of the San Francisco Bay Region," published in 1917 *(7)*, covers part of the present survey. The present survey, however, updates the earlier survey and provides additional information and larger maps that show the soils in greater detail.

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those on soil maps for adjacent survey areas. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils within the survey.

General Nature of the Survey Area

This section provides general information about the survey area. It discusses history and development; water supply; transportation facilities; physiography, relief, and drainage; and climate.

History and Development

The Costanoans, an American Indian tribe, inhabited the San Francisco Peninsula at least 3,000 years before the Europeans settled in the area. In 1769 a Spanish overland expedition led by Captain Gaspar de Portola discovered San Francisco Bay from Sweeney Ridge, just east of the present town of Pacifica. In 1776 Juan Bautista de Anza led an expedition to establish a fort and mission in the San Francisco Bay area.

Initially, the settlers used the San Francisco Peninsula for agriculture. They soon learned that growing crops in the foggy southern part was impractical, so they established agricultural outposts in the sunnier areas further north. With the establishment of Mexican rule in 1821 and the Secularization Act of 1834, land ownership shifted from Spanish domain to private ownership. More than a dozen vast tracts of land, known as ranchos, were awarded to individuals by the Mexican government. During this time, cattle

operations became the dominant enterprise in the area.

The Gold Rush brought many settlers to the San Francisco Peninsula, and the forests of the Woodside-Portola Valley area were used for the production of lumber. By the mid 1860's, these forests were depleted and the logging industry moved to areas along the coast. Floriculture on the peninsula dates from before 1900, and it is still important to the economy. It began as a hobby for wealthy estate owners but later flourished when nurseries were started by immigrants in the Daly City, Colma, Redwood City, Belmont, and San Mateo areas.

Until 1856 San Francisco County included all of the land north of San Francisquito Creek. At that time, San Mateo County was established and Redwood City became its county seat. An earthquake in 1906 resulted in a population upsurge in San Mateo County, as homeless San Franciscans sought refuge. Nine cities were established in the county in the first three decades of the 1900's.

Tanneries and meat packing plants were important to the early economy of San Mateo County. Shipbuilding and aviation became increasingly important after the turn of the century, and salt and cement production were important industries for many decades.

Water Supply

The basic source of water for the survey area is the Hetch Hetchy Reservoir on the Tuolumne River, in Tuolumne County. Water from this reservoir, which is managed by the City of San Francisco Water Department, flows to Crystal Springs Reservoir and San Andreas Lake, both of which are in San Mateo County. This reservoir provides the water for San Francisco County and 80 to 85 percent of the water used in the eastern part of San Mateo County.

The rest of the water for the eastern part of San Mateo County is supplied by public and private water districts and companies. Unincorporated areas that do not have access to municipal water supplies depend on wells and springs for water.

Transportation Facilities

The Golden Gate Bridge, the San Francisco-Oakland Bay Bridge, the San Mateo-Hayward Bridge, and the Dumbarton Bridge provide passage for motor vehicles, which are the major means of transportation in the area. Several major local, state, and federal highways serve the area. Among these are U.S. Highway 101, Interstate 280, and California Highways 1, 35, 84, and 92.

Freight and passenger railway service is available between Santa Clara County and San Francisco County.

Two airports in San Mateo County serve the area. These are San Francisco International Airport, which is 12 miles from San Francisco, and a county airport in San Carlos.

The Port of San Francisco serves ships engaged in coastal, intercoastal, and foreign trade.

Physiography, Relief, and Drainage

The survey area is located in the Coast Range. It is characterized by a number of northwest-facing mountains and intervening valleys.

The survey area consists of three general physiographic regions: (1) the rugged Santa Cruz Mountains, which range in elevation from near sea level along the Pacific Ocean and San Francisco Bay to about 2,000 feet above sea level at Sierra Morena; (2) the nearly level alluvial fans and intermountain valleys, which range in elevation from near sea level to 1,000 feet above sea level; and (3) the low-lying tidal marshes along San Francisco Bay, which range in elevation from 2 feet below sea level to 50 feet above sea level. Most of the 35 miles of shoreline along the bay has been reclaimed and is used for urban development.

Numerous intermittent streams that flow for short periods in winter drain most of the survey area. These are Colma, San Mateo, Belmont, Cordilleras, Redwood, and San Francisquito Creeks and their tributaries.

Climate

The city of San Francisco and nearby towns of San Bruno, South San Francisco, Daly City, Coma, and Pacifica are characterized by a marine climate with cool, moist winters and cool, foggy summers. Summer temperatures are influenced by low fog in the mornings and a steady flow of marine air from the Pacific Ocean in the afternoons. Because of the marine air flow, extreme temperatures, either hot or cold, are rare. As the marine influence diminishes southward along San Francisco Bay and east of the Coast Range, summers become slightly warmer and winters slightly cooler.

Temperature and precipitation data, as recorded at Redwood City and San Francisco, are given in table 1. Variations in temperature are very minimal in the areas influenced by a marine climate, but they are slightly greater in the areas inland and southward along San Francisco Bay. The temperature of the sea water greatly influences the temperature in the survey area.

The average surface temperature of the sea water near San Francisco ranges from 51 degrees F in January to 60 degrees in August and September. The warmest temperatures in the area occur late in summer and in fall in areas near the coast.

The growing season, the period between the last freezing temperature in spring and the first in fall, ranges from 275 to 350 days. It is about 275 days at the higher elevations in southeastern San Mateo County, more than 300 days along San Francisco Bay, and 350 days along the coast of the Pacific Ocean.

Most of the annual precipitation falls during November through April. The average annual precipitation varies from about 15 inches along the bay near Menlo Park to 20 inches along the coast and along the bay near Brisbane and Burlingame. The average precipitation increases with elevation to about 45 inches near Pilarcitos Lake. Figure 1 shows the distribution of precipitation in the survey area.

The average evaporation rate is 4.5 feet per year according to measurements taken at Crystal Springs Reservoir, Pilarcitos Lake, and San Andreas Lake by the San Francisco Water Department.

Records at the San Francisco Federal Office Building and San Francisco International Airport show that the prevailing winds dominantly are from the west and west-northwest, respectively. Average windspeed is 6 to 14 miles per hour throughout the year. The westerly winds during summer exhibit a marked diurnal variation in speed, increasing to a maximum of about 20 miles per hour late in the afternoon. Strong winds, occasionally of gale force, occur along the coast. At times winds sweep down the Coast Range with speeds estimated at more than 75 miles per hour.

The relative humidity in the San Francisco Bay area generally is quite high, averaging 65 to 75 percent in the afternoon. The highest relative humidity occurs in summer as a result of the prevailing winds and coastal fog. Relative humidity decreases as distance from the ocean increases.

In San Francisco County and on the northern side of the eastern part of San Mateo County, the sun shines about 50 percent of the time possible throughout the year. Southward along the bay and inland to Skyline Boulevard, the sun shines 60 to 70 percent of the time possible.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage, the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the

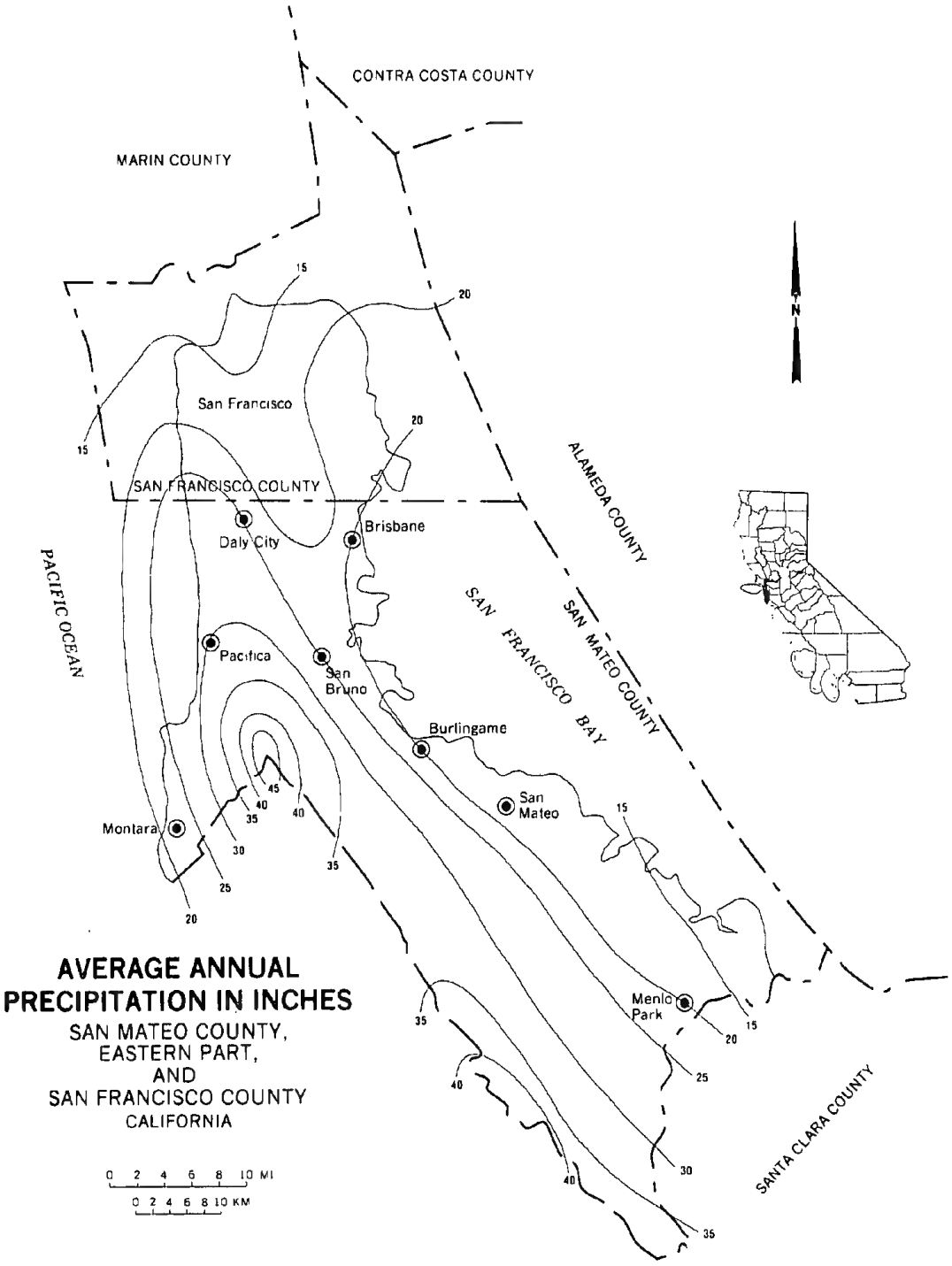

Figure 1.—Average annual precipitation in the survey area.

same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil

scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The soils or miscellaneous areas making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land use. Areas of suitable soils or miscellaneous areas can be identified on the map. Likewise, areas that are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The general map units in this survey have been grouped into general kinds of landscape for broad interpretive purposes. Each of the broad groups and the map un ts in each group are described in the following pages. Figures 2 and 3 show a cross section of the general soil map units in areas of San Mateo County.

Map Unit Descriptions

Soils on Coastal Dunes, Terraces, and Hills

Two map units are in this group. They make up about 13 percent of the total land area in the survey area.

1. Urban Land-Sirdrak

Urban land, and very deep, gently sloping to steep, somewhat excessively drained soils; on coastal dunes

This map unit is in San Francisco County and northwestern San Mateo County. The soils in this unit formed dominantly in windblown deposits. Slope ranges from 2 to 50 percent. Elevation ranges from 10 to 800 feet. The average annual precipitation is about 15 to 25 inches, the average annual air temperature is about 54 to 56 degrees F, and the average frost-free season is about 300 to 350 days.

This unit makes up about 7 percent of the total land area in the survey area. It is about 45 percent Urban land, 40 percent Sirdrak soils, and 15 percent components of minor extent.

Urban land consists of areas covered by roads, driveways, parking lots, houses, and other structures. The soil under these structures has been graded and mixed or has been covered with fill material.

Sirdrak soils are very deep and somewhat excessively drained. They are on stabilized dunes. These soils are dark brown sand over yellowish brown sand.

Of minor extent in this unit are beaches, dune land, Barnabe and Candlestick soils, and Orthents.

Most areas of this unit are used for urban and recreational development or as wildlife habitat.

The Sirdrak soils have a low available water capacity; therefore, they are suited to only the most drought-resistant plants. Barren areas of these soils are subject to soil blowing.

Irrigated lawns and landscape plantings provide habitat for wildlife, such as robins, hummingbirds, sparrows, and house finches. Shrubs and trees provide habitat and protection from ocean winds. Management practices that can enhance the wildlife habitat include providing drinking water, preserving existing shrubby growth, and including flowering and fruit-producing shrubs and trees in landscape plantings.

2. Urban Land-Orthents, Smoothed

Urban land, and very shallow to very deep, moderately sloping to steep, well drained soils underlain by soft sandstone; on coastal terraces and hills

This map unit is in the San Francisco, Daly City, and northern Pacifica areas. The soils in this unit formed in material derived from soft sandstone. Slope ranges

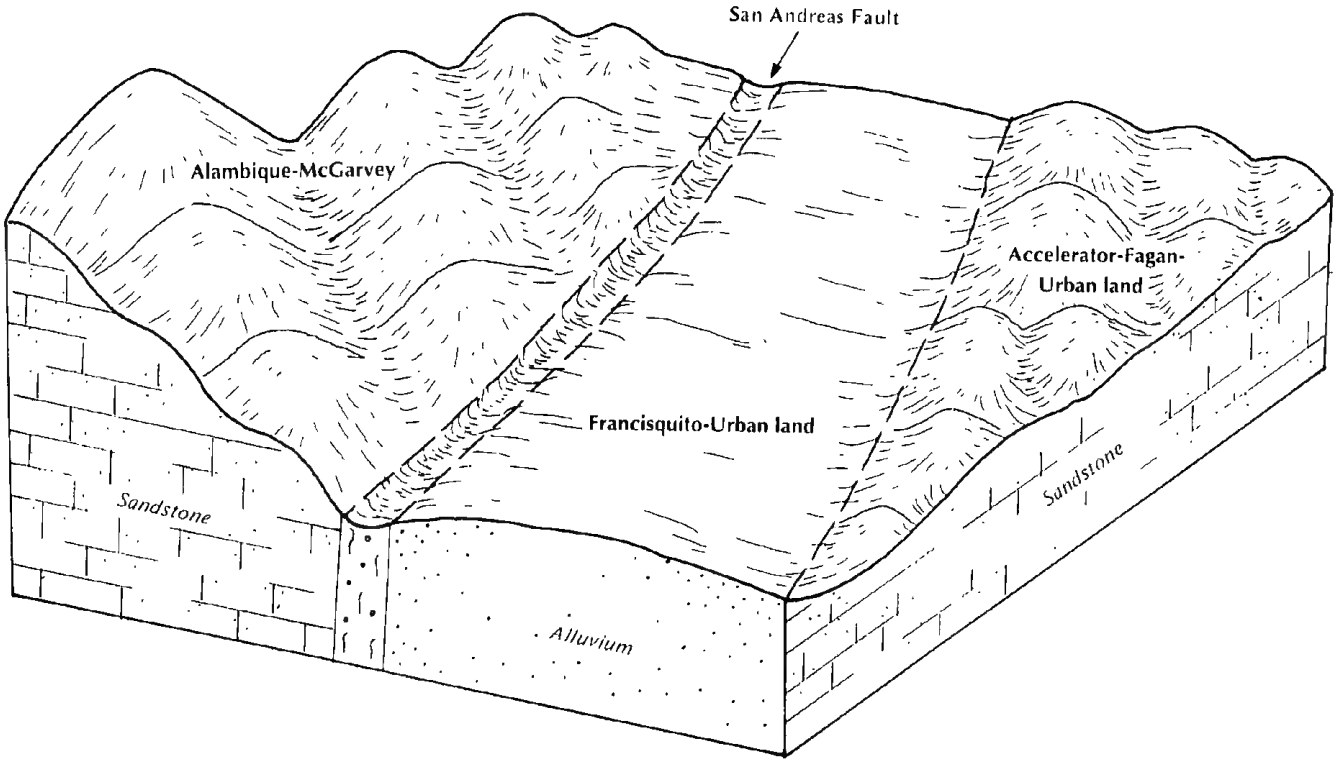

Figure 2.—Idealized cross section of soils adjacent to the San Andreas Fault near Searsville Lake, in the southern part of San Mateo County.

from 5 to 50 percent. Elevation ranges from 100 to 500 feet. The average annual precipitation is about 25 to 35 inches, the average annual air temperature is about 54 to 56 degrees F, and the average frost-free season is about 300 to 350 days.

This unit makes up about 6 percent of the total land area in the survey area. It is about 65 percent Urban land, 25 percent Orthents, and 10 percent soils of minor extent.

Urban land consists of areas covered by roads, driveways, parking lots, houses, and other structures. The soil under these structures has been graded and mixed or has been covered with fill material.

Orthents, smoothed, are very shallow to very deep and are well drained. These soils are pinkish gray fine sandy loam over light brownish gray loam and sandy loam.

Of minor extent in this unit are Sirdrak, Candlestick, Buriburi, and Barnabe soils.

Most areas of this unit are used for urban and homesite development.

This unit is limited by the slope and the hazard of erosion.

Irrigated lawns and landscape plantings provide habitat for wildlife, such as sparrows, house finches, mourning doves, and blackbirds. Management practices that can enhance the wildlife habitat include planting and preserving flowering and fruit-producing shrubs and trees in landscape plantings, providing drinking water, and providing birdhouses.

Soils on Uplands

Seven map units are in this group. They make up about 49 percent of the total land area in the survey area.

3. Alambique-McGarvey

Moderately deep, moderately steep to very steep, well drained soils underlain by sandstone; on uplands

This map unit is west of the San Andreas Fault and south of California Highway 92, in the San Francisco Water District. The soils in this unit formed in material weathered from sandstone. Slope ranges from 30 to 75 percent. Elevation ranges from 350 to 2,000 feet. The average annual precipitation is about 30 to 40 inches,

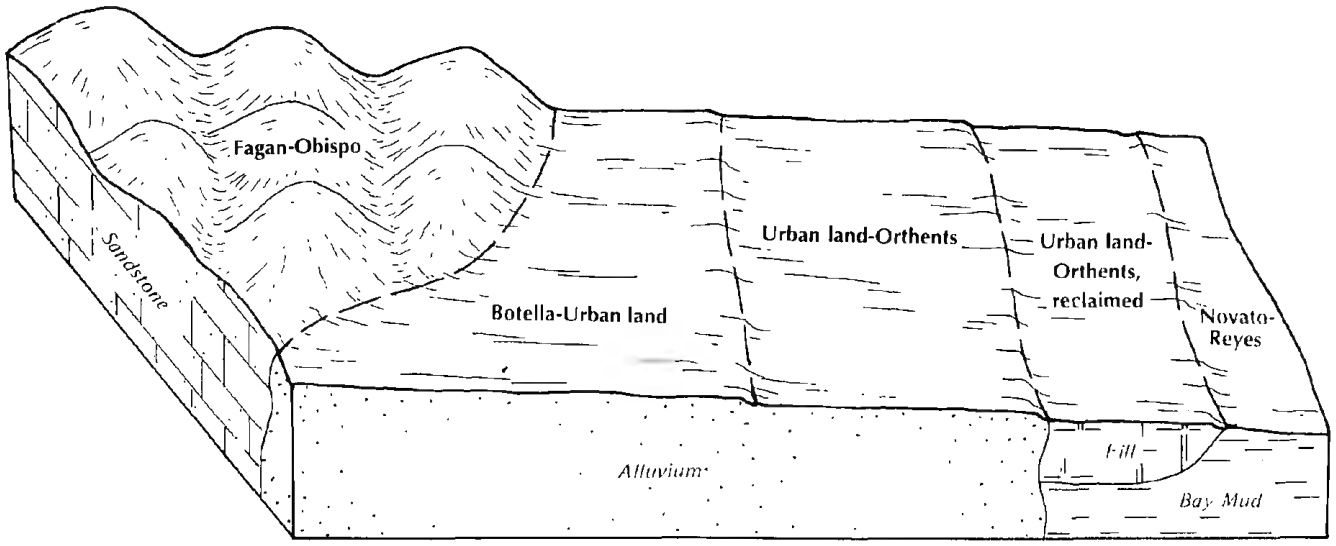

Figure 3.—Idealized cross section of soils near Redwood City, in the southeastern part of San Mateo County.

the average annual air temperature is about 54 to 56 degrees F, and the average frost-free season is about 275 to 330 days.

This unit makes up about 11 percent of the total land area in the survey area. It is about 45 percent Alambique soils, 35 percent McGarvey soils, and 20 percent components of minor extent.

Alambique soils are moderately deep and well drained. The surface layer is brown gravelly loam. The underlying material is reddish yellow gravelly loam. It is underlain by weathered sandstone.

McGarvey soils are moderately deep and well drained. The surface layer is pinkish gray loam. The subsoil is light reddish brown clay loam. It is underlain by weathered sandstone.

Of minor extent in this unit are Barnabe, Buriburi, Candlestick, Candlestick Variant, and Kron soils; Orthents; and Urban land.

Most areas of this unit are used mainly as watershed, for recreation, or as wildlife habitat. Some areas are used for timber production.

This unit is limited by the slope and the hazard of erosion.

This unit supports extensive stands of madrone, tanoak, California bay, Douglas fir, and redwood. Understory plants include manzanita, poison oak, and brackenfern. The unit provides habitat for wildlife, such as band-tailed pigeon, California quail, coyote, bobcat, rodents, songbirds, and birds of prey. Drinking water is available from reservoirs and creeks. Maintaining the existing vegetation is the main management concern for much of this unit.

4. Scarper-Miramar

Moderately deep, steep and very steep, well drained soils underlain by quartz-diorite; on uplands

This map unit is along the coast, extending from south of Devils Slide to Montara. The soils in this unit formed in material weathered from quartz-diorite. Slope ranges from 30 to 75 percent. Elevation ranges from 200 to 1,800 feet. The average annual precipitation is about 20 to 45 inches, the average annual air temperature is about 54 to 56 degrees F, and the average frost-free season is about 300 to 350 days.

This unit makes up about 2 percent of the total land area in the survey area. It is about 40 percent Scarper soils, 35 percent Miramar soils, and 25 percent components of minor extent.

Scarper soils are moderately deep and well drained. The surface layer is dark grayish brown gravelly coarse sandy loam. The underlying material is brown gravelly coarse sandy loam. It is underlain by quartz-diorite.

Miramar soils are moderately deep and well drained. The surface layer is dark grayish brown loam. The subsoil is brown clay loam. It is underlain by quartz-diorite.

Of minor extent in this unit are Barnabe, Kron, and Candlestick soils, Typic Argiustolls, Rock outcrop, and Urban land.

Most areas of this unit are used for recreation, as watershed, or as wildlife habitat.

This unit is limited by the slope, the hazard of erosion, and a restricted available water capacity. Recreational development on this unit is limited mainly to a few paths and trails.

This unit supports coastal scrub vegetation, including California sagebrush, coyotebrush, buckwheat, and monkeyflower. There are a few small areas of grassland. The unit provides habitat for wildlife, such as black-tailed deer, bobcat, California quail, California thrasher, white-crowned sparrow, Anna's hummingbird, and various birds of prey. Drinking water is scarce on this unit. Managing brush and providing drinking water can enhance the wildlife habitat, but these practices are limited by the slope.

5. Barnabe-Candlestick-Buriburi

Very shallow to moderately deep, moderately steep to very steep, well drained soils underlain by sandstone; on uplands

This map unit is on San Bruno Mountain; Sweeney Ridge, west of Pacifica; and Skyline Boulevard, south of California Highway 92. The soils in this unit formed in material weathered from sandstone. Slope ranges from 15 to 75 percent. Elevation ranges from 75 to 1,350 feet. The average annual precipitation is about 20 to 30 inches, the average annual temperature is about 54 to 56 degrees F, and the average frost-free season is about 300 to 350 days.

This unit makes up about 12 percent of the total land area in the survey area. It is about 30 percent Barnabe soils, 30 percent Candlestick soils, 15 percent Buriburi soils, and 25 percent components of minor extent.

Barnabe soils are very shallow and shallow. Slope ranges from 15 to 75 percent. These soils are dark grayish brown very gravelly sandy loam over hard, highly fractured sandstone.

Candlestick soils are moderately deep. Slope ranges from 30 to 75 percent. The upper part of the surface layer is brown fine sandy loam, and the lower part is brown loam. The subsoil is pale brown sandy clay loam over hard, fractured sandstone.

Buriburi soils are moderately deep. Slope ranges from 30 to 75 percent. These soils are dark grayish brown and grayish brown gravelly loam over hard, fractured sandstone.

Of minor extent in this unit are Candlestick Variant and Kron soils, Orthents, Rock outcrop, Pits and Dumps, and Urban land.

Most areas of this unit are used for recreation, as wildlife habitat, or for urban development.

This unit is limited by the slope, the hazard of erosion, and a potential for slippage in areas of the Candlestick soils.

This unit supports large areas of shrubs interspersed with areas of grassland. Shrubs, such as coyotebrush and poison oak, provide cover for wildlife, including black-tailed deer, bobcat, rabbits, various rodents, California quail, songbirds, and birds of prey. Practices that can enhance the wildlife habitat include providing drinking water and managing brush to achieve more diverse habitat. Onsite investigation is essential in the selection of areas suited to these practices.

6. Fagan-Obispo

Shallow and deep, gently rolling to steep, well drained soils underlain by sandstone, shale, and serpentine; on uplands

This map unit is along California Highway 92, on the eastern side of the San Andreas Fault zone. The soils in this unit formed in material weathered from sandstone, shale, and serpentine. Slope ranges from 5 to 50 percent. Elevation ranges from 200 to 2,000 feet. The average annual precipitation is about 20 to 35 inches, the average annual air temperature is about 56 to 58 degrees F, and the average frost-free season is about 275 to 330 days.

This unit makes up about 4 percent of the total land area in the survey area. It is about 60 percent Fagan soils, 25 percent Obispo soils, and 15 percent components of minor extent.

Fagan soils are deep. Slope ranges from 15 to 50 percent. The surface layer is brown loam. The subsoil is yellowish brown sandy clay loam and clay. It is underlain by sandstone and shale.

Obispo soils are shallow. Slope ranges from 5 to 30 percent. The surface layer is dark gray clay. The underlying material is very dark gray clay. It is underlain by hard, serpentinitic rock.

Of minor extent in this unit are Urban land; Maymen, Candlestick Variant, and Los Gatos soils; and Orthents, cut and fill.

Most areas of this unit are used as watershed, for recreation, as wildlife habitat, or for urban development.

This unit is limited by the slope, the hazard of erosion, a potential for shrinking and swelling in areas of the Obispo soils, and a potential for slippage in areas of the Fagan soils.

This unit supports open grassland areas and limited areas of shrubs, such as coyotebrush. It provides habitat for wildlife, including rabbits, various rodents,

California quail, western meadowlark, sparrows, and merlin and other birds of prey. Shrubs and trees provide cover for wildlife and perches for birds of prey and are a valuable part of the habitat. Management practices that can enhance the wildlife habitat include planting shrubs or trees in odd areas or as windbreaks and providing drinking water near areas of protective cover.

7. Urban Land-Orthents, Cut and Fill

Urban land, and very shallow to very deep, gently rolling to very steep, well drained soils underlain by sandstone; on uplands

This map unit is east of California Highway 280, extending from San Bruno to Redwood City. The soils in this unit formed in residuum derived from sandstone. Slope ranges from 5 to 75 percent. Elevation ranges from 20 to 800 feet. The average annual precipitation is about 15 to 30 inches, the average annual air temperature is about 54 to 58 degrees F, and the average frost-free season is about 275 to 350 days.

This unit makes up about 16 percent of the total land area in the survey area. It is about 45 percent Urban land; 45 percent Orthents, cut and fill; and 10 percent soils of minor extent.

Urban land consists of areas covered by driveways, parking lots, houses, and other structures. The soil under these structures has been graded and mixed or has been covered with fill material.

Orthents, cut and fill, consist of areas of soils that have been cut or filled and graded by earth-moving equipment. Fill areas are made up of varying amounts of soil, gravel, and other material.

Of minor extent in this unit are Accelerator, Fagan, Obispo, Maymen, and Los Gatos soils.

Most areas of this unit are used for urban, recreational, and homesite development.

This unit is limited by the slope in most areas, the hazard of erosion, and the variable texture of the material in fill areas.

Irrigated lawns and landscape plantings provide habitat for wildlife, such as blackbirds, sparrows, house finches, and robins. Management practices that can enhance the wildlife habitat in urban areas include planting and preserving flowering and fruit-producing shrubs and trees in landscape plantings, providing drinking water, and providing birdhouses.

8. Accelerator-Fagan-Urban Land

Deep, gently rolling and rolling, well drained soils underlain by sandstone, shale, and siltstone, and Urban land; on uplands

This map unit is along California Highway 280, north of San Francisquito Creek. The soils in this unit formed in residuum derived from sandstone, shale, and siltstone. Slope ranges from 5 to 15 percent. Elevation ranges from 100 to 500 feet. The average annual precipitation is about 25 to 30 inches, the average annual air temperature is about 56 to 58 degrees F, and the average frost-free season is about 275 to 330 days.

This unit makes up about 2 percent of the total land area in the survey area. It is about 40 percent Accelerator soils, 25 percent Fagan soils, 15 percent Urban land, and 20 percent soils of minor extent.

Accelerator soils are deep and well drained. The surface layer is light gray loam. The subsoil is light gray and yellow clay loam and gravelly clay loam. It is underlain by siltstone and sandstone.

Fagan soils are deep and well drained. The surface layer is brown loam. The subsoil is yellowish brown clay loam and clay. It is underlain by sandstone and shale.

Urban land consists of areas covered by roads, driveways, parking lots, houses, and other structures. The soil under these structures has been graded and mixed or has been covered with fill material.

Of minor extent in this unit are Obispo, Francisquito, Candlestick Variant, and Los Gatos soils.

Most areas of this unit are used for homesite and recreational development or as wildlife habitat.

This unit is limited by the slope, the hazard of erosion, and restricted permeability.

The areas of grassland and the scattered hardwood trees on this unit provide habitat for wildlife, such as sparrows, finches, mourning dove, birds of prey, long-tailed weasel, and rodents. Maintaining the hardwood trees and grassland vegetation where possible helps to protect the wildlife habitat on this unit. Stream-associated vegetation provides valuable habitat and should also be maintained where possible. Planting and maintaining a variety of flowering and fruit-producing shrubs and trees can enhance the wildlife habitat. Additional wildlife may be attracted to the urban areas of this unit if drinking water and birdhouses are provided.

9. Alambique-Zeni-Zeni Variant

Moderately deep, moderately steep to very steep, well drained soils underlain by sandstone and metasedimentary rock; on uplands

This map unit is on Sawyer Ridge and Cahill Ridge, in the San Francisco Water District. The soils in this unit formed in material weathered from sandstone and metasedimentary rock. Slope ranges from 15 to 75

percent. Elevation ranges from 300 to 1,100 feet. The average annual precipitation is about 30 to 45 inches, the average annual air temperature is about 54 to 56 degrees F, and the average frost-free season is about 275 to 330 days.

This unit makes up about 2 percent of the total land area in the survey area. It is about 45 percent Alambique soils, 25 percent Zeni soils, 15 percent Zeni Variant soils, and 15 percent soils of minor extent.

Alambique soils are moderately deep and well drained. Slope ranges from 15 to 75 percent. The surface layer is brown sandy loam. The underlying material is brown and grayish brown loam. It is underlain by hard sandstone.

Zeni soils are moderately deep and well drained. Slope ranges from 30 to 75 percent. The surface layer is pale brown gravelly loam. The subsoil is reddish yellow and very pale brown gravelly clay loam. It is underlain by sandstone.

Zeni Variant soils are moderately deep and well drained. Slope ranges from 30 to 75 percent. The surface layer is very dark grayish brown gravelly loam. The subsoil is pale brown, very pale brown, and light yellowish brown gravelly clay loam and very gravelly clay loam. It is underlain by hard, fractured metasedimentary rock.

Of minor extent in this unit are Maymen, Barnabe, Kron, and McGarvey soils.

Most areas of this unit are used as watershed or wildlife habitat.

This unit is limited by the slope and the hazard of erosion.

This unit supports trees and shrubs, such as tanoak, madrone, Douglas fir, manzanita, and blueblossom ceanothus. It provides habitat for many kinds of wildlife, including black-tailed deer, gray fox, coyote, bobcat, band-tailed pigeon, scrub jay, and western flycatcher. Reservoirs and creeks provide drinking water. Maintaining the existing vegetation is the main management concern for much of this unit.

Soils on Bottom Lands

Five map units are in this group. They make up about 38 percent of the total land area in the survey area.

10. Novato-Reyes

Very deep, nearly level, very poorly drained and somewhat poorly drained soils; on tidal flats

This map unit is on the eastern edge of the survey area, along the margins of San Francisco Bay. The soils formed in alluvium derived from various kinds of rock, in sediment from San Francisco Bay, and in hydrophytic plant material. Slope is 0 to 1 percent. Elevation ranges from 2 feet below sea level to 5 feet above sea level. The average annual precipitation is about 15 to 25 inches, the average annual air temperature is about 56 to 58 degrees F, and the average frost-free season is about 275 to 330 days.

This unit makes up about 6 percent of the total land area in the survey area. It is about 55 percent Novato soils, 35 percent Reyes soils, and 10 percent components of minor extent.

Novato soils are very poorly drained. They are in tidal marshes. These soils are gray clay over light olive gray, gray, and dark gray clay.

Reyes soils are somewhat poorly drained. They are on reclaimed tidelands. These soils are gray clay throughout.

Of minor extent in this unit are Urban land, Orthents, and Botella soils.

This unit is used mainly as wildlife habitat, recreation areas, or evaporation ponds for the production of salt.

This unit is limited by water at or near the surface and by the susceptibility of the soils to subsidence.

About two-thirds of the areas of Novato soils is diked and used as evaporation ponds for the production of salt. These areas support invertebrates that are used as food by numerous kinds of shore birds. Scaup and other ducks also feed at these ponds. Dikes surrounding the ponds are used as resting and nesting areas for shore birds and waterfowl.

The other one-third of the areas of Novato soils is not diked and is subject to tidal action. These areas are located just above the tidal mudflats of San Francisco Bay and along the creeks and sloughs entering the bay. Vegetation in these areas is mostly pickleweed and other salt-tolerant plants, such as saltgrass, California cordgrass, and alkali bulrush. These areas provide valuable habitat for numerous shore birds and waterfowl. The endangered saltmarsh harvest mouse and California clapper rail also use the habitat in these areas. Management practices that protect these areas from tidal action and that maintain the vegetation are needed.

The Reyes soils are protected from tidal action by dikes and are drained. Vegetation on levees and in areas inside levees provides habitat for wildlife, such as California quail, mourning dove, rabbits, western meadowlark, rodents, marsh hawks, and white-tailed kites. Management practices that preserve the existing shrubs and herbaceous plants can enhance the wildlife habitat on these soils.

11. Urban Land-Orthents, Reclaimed

Urban land, and very deep, nearly level, poorly drained and somewhat poorly drained soils; on reclaimed tidal flats

This map unit is on the eastern edge of the survey area, along San Francisco Bay. Slope ranges from 0 to 2 percent. Elevation ranges from 0 to 50 feet. The average annual precipitation is about 15 to 30 inches, the average annual air temperature is about 54 to 58 degrees F, and the average frost-free season is about 275 to 330 days.

This unit makes up about 13 percent of the total land area in the survey area. It is about 65 percent Urban land; 20 percent Orthents, reclaimed; and 15 percent soils of minor extent and bodies of water.

Urban land consists of areas covered by asphalt, concrete, buildings, and other structures. The soil under these structures has been graded and mixed or has been covered with fill material.

Orthents, reclaimed, consist of areas of fill material that is made up of varying amounts of soil, rock fragments, broken concrete and asphalt, bay mud, and solid waste material.

Of minor extent in this unit are Reyes and Novato soils and bodies of water.

This unit is used for homesite, urban, and recreational development.

This unit is limited by the susceptibility of the soils to subsidence, a permanent high water table, and the highly variable texture of the Orthents.

Odd areas of the Reyes and Novato soils provide remnants of wildlife habitat; however, the natural vegetation commonly has been reduced or destroyed by development. Irrigated lawns and landscape plantings provide habitat for wildlife, such as songbirds, doves, and pigeons. Management practices that can enhance the habitat include maintaining the natural vegetation, using flowering and fruit-producing shrubs and trees in landscape plantings, and providing drinking water and birdhouses.

12. Urban Land-Orthents

Urban land, and deep and very deep, nearly level and gently sloping, poorly drained to well drained soils; on alluvial fans, flood plains, and coastal terraces

This map unit is west of Bayshore Freeway, extending from San Bruno to Redwood City. Slope ranges from 0 to 5 percent. Elevation ranges from 10 to 600 feet. The average annual precipitation is about 15 to 30 inches, the average annual air temperature is about 54 to 58 degrees F, and the average frost-free season is about 275 to 330 days.

This unit makes up about 13 percent of the total land area in the survey area. It is about 45 percent Urban land, 45 percent Orthents, and 10 percent soils of minor extent.

Urban land consists of areas covered by roads, driveways, parking lots, houses, and other structures. The soil under these structures has been graded and mixed or has been covered with fill material.

Orthents consist of areas of soils where the upper part has been graded and moved for homesite or urban development. The texture of the surface layer is highly variable.

Of minor extent in this unit are Botella and Novato soils.

This unit is used for homesite, urban, and recreational development.

This unit is limited by restricted permeability in some areas and by the highly variable surface texture of the Orthents.

Occasional streams and waterways still traverse this unit; however, the habitat provided by associated streamside vegetation commonly has been reduced or destroyed by development. Irrigated lawns and landscape plantings provide habitat for wildlife, such as songbirds, doves, and pigeons. Management practices that can enhance the wildlife habitat include planting and maintaining a variety of flowering and fruit-producing shrubs and trees and providing drinking water and birdhouses.

13. Botella-Urban Land

Very deep, nearly level and gently sloping, well drained soils, and Urban land; on alluvial fans, flood plains, and stream terraces

This map unit is along San Francisquito Creek and in the Menlo Park and Palo Alto areas. Slope ranges from 0 to 5 percent. Elevation ranges from 5 to 400 feet. The average annual precipitation is about 15 to 25 inches, the average annual air temperature is about 56 to 58 degrees F, and the average frost-free season is about 275 to 330 days.

This unit makes up about 3 percent of the total land area in the survey area. It is about 55 percent Botella soils, 30 percent Urban land, and 15 percent soils of minor extent.

Botella soils formed in alluvium derived from various kinds of rock. The surface layer is dark grayish brown loam. The subsoil is dark grayish brown clay loam.

Urban land consists of areas covered by roads,

driveways, parking lots, houses, and other structures. The soil under these structures has been graded and mixed or has been covered with fill material.

Of minor extent in this unit are Orthents and soils that are similar to the Botella soils but have more clay in the subsoil.

Most areas of this unit are used for urban and homesite development or for irrigated row crops.

This unit has few limitations for most uses.

Scattered oaks and areas of grassland provide habitat for wildlife, such as blackbirds, finches, red-tailed hawk, American kestrels, long-tailed weasels, opossum, and rodents. Protecting the vegetation is important if the existing wildlife populations are to be maintained. Stream-associated vegetation on this unit provides valuable wildlife habitat and should be maintained where possible. Practices that can enhance wildlife habitat in the urban areas of this unit include planting and maintaining a variety of flowering and fruit-producing shrubs and trees and providing drinking water and birdhouses.

14. Francisquito-Urban Land

Very deep, gently rolling and rolling, well drained soils, and Urban land; on terraces

This map unit is near the Portola Valley and Woodside areas. Slope ranges from 5 to 15 percent. Elevation ranges from 400 to 500 feet. The average annual precipitation is about 25 to 35 inches, the average annual air temperature is about 56 to 58 degrees F, and the average frost-free season is about 275 to 330 days.

This unit makes up about 3 percent of the total land area in the survey area. It is about 45 percent Francisquito soils, 35 percent Urban land, and 20 percent soils of minor extent.

Francisquito soils formed in old alluvium derived from various kinds of rock. The surface layer is light yellowish brown loam. The subsoil is variegated, light yellowish brown and strong brown clay loam and clay.

Urban land consists of areas covered by roads, driveways, parking lots, houses, and other structures. The soil under these structures has been graded and mixed or has been covered with fill material.

Of minor extent in this unit are Candlestick Variant, Los Gatos, Obispo, Fagan, and Accelerator soils.

This unit is used for homesite development, wildlife habitat, and recreational development.

This unit is limited by restricted permeability of the subsoil in the Francisquito soils.

Areas of grassland and hardwood trees provide habitat for wildlife, such as band-tailed pigeon, California quail, coyote, rodents, and songbirds. Protecting the existing vegetation enhances wildlife habitat on this unit. Stream-associated vegetation is especially important to wildlife and should be protected where possible. Planting and maintaining a variety of flowering and fruit-producing shrubs and trees in urban areas provides food and cover for wildlife. Additional birds can be attracted to urban areas if drinking water and birdhouses are provided.

Detailed Soil Map Units

The map units delineated on the detailed maps at the back of this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit is given under "Use and Management of the Soils."

A map unit delineation on a map represents an area dominated by one or more major k nds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Otner included soils and miscellaneous areas, however, have properties and behavior divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation is needed to precisely define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying layers, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underly ng layers. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Novato clay, 0 to 1 percent slopes, ponded, is a phase of the Novato series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes or associations.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in

such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alambique-McGarvey complex, 30 to 75 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Typic Argiustolls, loamy-Urban land association, 5 to 15 percent slopes, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits and Dumps is an example.

Table 2 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

Map Unit Descriptions

101—Accelerator-Fagan association, 5 to 15 percent slopes. This map unit is on uplands. Slope is 5 to 15 percent. The native vegetation is mainly annual grasses and forbs on the Accelerator soil and oaks and other hardwoods on the Fagan soil. Elevation is 200 to 500 feet. The average annual precipitation is about 25 to 30 inches, the average annual air temperature is 56 to 58 degrees F, and the average frost-free period is 275 to 330 days.

This unit is 45 percent Accelerator loam and 30 percent Fagan loam. The Accelerator soil is on gently rolling uplands, and the Fagan soil generally is on rolling uplands.

The Accelerator soil is deep and well drained. It formed in material weathered from soft sandstone and siltstone. Typically, the surface layer is light gray and light brownish gray loam about 23 inches thick. The upper 6 inches of the subsoil is light gray clay loam, and the lower 12 inches is yellow gravelly clay loam. Soft siltstone and sandstone are at a depth of 41 inches. The depth to bedrock ranges from 40 to 60 inches.

The Fagan soil is deep and well drained. It formed in material weathered from soft sandstone and shale. Typically, the surface layer is brown loam over grayish brown clay loam about 19 inches thick. The upper 7 inches of the subsoil is yellowish brown clay loam, and the lower 17 inches is yellowish brown clay. Soft sandstone and shale are at a depth of 43 inches. The depth to bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of soils that are less than 40 inches deep to sandstone and are loam throughout and soils that are grayish brown clay, are 40 inches thick or more, and have a high shrink-swell potential. Also included are small areas of soils that are similar to the Accelerator soil but have a clay subsoil, are neutral or mildly alkaline, or are more than 60 inches thick; small areas of soils that are similar to the Fagan soil but have a brown and grayish brown loam surface layer that is more than 20 inches thick; and a few areas of soils that have slopes of less than 5 percent or more than 15 percent. Included soils make up about 25 percent of the total acreage.

Permeability is moderately slow in the Accelerator soil and slow in the Fagan soil. The available water capacity is moderate or high in both soils. Effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for Christmas tree production. It is also used for equestrian facilities, as watershed, or as wildlife habitat.

If this unit is used for Christmas tree production, the main limitation is the slope. The trees should be planted on the contour to reduce the risk of erosion. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate.

This map unit is in capability unit IIIe-1 (15), nonirrigated.

102—Accelerator-Fagan-Urban land complex, 5 to 15 percent slopes. This map unit is on uplands. Slope is 5 to 15 percent. The native vegetation is mainly annual grasses and forbs and a few scattered oaks. Elevation is 100 to 400 feet. The average annual precipitation is about 25 to 30 inches, the average annual air temperature is 56 to 58 degrees F, and the average frost-free period is 275 to 330 days.

This unit is 35 percent Accelerator loam, 25 percent Fagan loam, and 25 percent Urban land. The Accelerator soil is on gently rolling uplands under grassland vegetation, and the Fagan soil generally is on rolling uplands under oaks and other hardwood trees and annual grasses.

The Accelerator soil is deep and well drained. It formed in material weathered from soft sandstone and siltstone. Typically, the surface layer is light gray and

light brownish gray loam about 23 inches thick. The upper 6 inches of the subsoil is light gray clay loam, and the lower 12 inches is yellow gravelly clay loam. Soft siltstone and sandstone are at a depth of 41 inches. The depth to bedrock ranges from 40 to 60 inches.

The Fagan soil is deep and well drained. It formed in material weathered from soft sandstone and shale. Typically, the surface layer is brown loam over grayish brown clay loam about 19 inches thick. The upper 7 inches of the subsoil is yellowish brown clay loam, and the lower 17 inches is yellowish brown clay. Soft sandstone and shale are at a depth of 43 inches. The depth to bedrock ranges from 40 to 60 inches.

Urban land consists of areas covered by asphalt, concrete, buildings, and other structures. The material covered by these structures consists of soils that are similar to the Accelerator and Fagan soils.

Included in this unit are small areas of Botella soils, loamy soils that are less than 40 inches thick, and clayey soils that are 40 inches thick or more and have a high shrink-swell potential throughout the profile. Also included are small areas of soils that are similar to the Accelerator soil but have a clay subsoil, are neutral or mildly alkaline, or are more than 60 inches thick; soils that are similar to the Fagan soil but have a brown or grayish brown surface layer that is more than 20 inches thick; and a few areas of soils that have slopes of less than 5 percent or more than 15 percent. Included soils make up about 15 percent of the total acreage.

Permeability is moderately slow in the Accelerator soil and slow in the Fagan soil. The available water capacity is moderate or high in both soils. Effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for urban development.

If this unit is used for homesite and urban development, it is limited mainly by the slope and by the high shrink-swell potential and slow permeability of the subsoil in the Fagan soil. Septic tank absorption lines should be installed on the contour. The restricted permeability can be overcome by increasing the size of the absorption field. Properly designing foundations and footings and diverting runoff away from buildings help to prevent the structural damage caused by the high shrink-swell potential. Excavation for roads and buildings increases the risk of erosion. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion. Plans for homesite development should provide for the preservation of as many trees as possible. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

The Accelerator and Fagan soils are in capability unit IIIe-1 (15), nonirrigated, and the Urban land is in capability class VIII (15).

103—Alambique sandy loam, 15 to 75 percent slopes. This moderately deep, well drained soil is on uplands. It formed in material weathered from hard sandstone. Slope is 15 to 75 percent. The native vegetation is mainly Douglas fir, hardwoods, and brush. Elevation is 300 to 1,000 feet. The average annual precipitation is 30 to 45 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 275 to 330 days.

Typically, the surface is covered with a mat of partially decomposed leaves and twigs about 4 inches thick. The surface layer is brown sandy loam about 6 inches thick. The underlying material to a depth of 30 inches is brown and grayish brown loam. Hard sandstone is at a depth of 30 inches. The depth to sandstone ranges from 20 to 40 inches.

Included in this unit are small areas of Zeni and Zeni Variant soils and Rock outcrop. Also included are small areas of soils that are similar to the Alambique soil but are less than 20 inches deep to sandstone and soils that have slopes of less than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability is moderate in the Alambique soil. The available water capacity is low or moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid or very rapid, and the hazard of water erosion is high or very high.

This unit is used mainly as watershed or wildlife habitat. Some areas are used for timber production.

This unit is suited to the production of Douglas fir. On the basis of a 100-year site curve, the mean site index for Douglas fir is 130. The unit can produce about 10,240 cubic feet, or 42,600 board feet (Scribner rule), of merchantable timber per acre from an even-aged, fully stocked stand of Douglas fir trees 80 years old.

The slope limits the kinds of equipment that can be used in forest management. Tractor logging can be used in the less sloping areas. Highlead or cable logging methods can be used in the steeper areas. The use of these methods is limited during November through April. Minimizing the risk of erosion is essential when timber is harvested. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Hand planting of nursery stock generally is necessary to establish or improve a stand. Reforestation must be carefully managed to reduce

competition from undesirable understory plants.

This map unit is in capability subclass VIIe (4), nonirrigated.

104—Alambique-McGarvey complex, 30 to 75 percent slopes. This map unit is on uplands. Slope is 30 to 75 percent. The native vegetation is mainly conifers, hardwoods, and shrubs on the Alambique soil and tanoak and redwoods on the McGarvey soil. Elevation is 350 to 2,000 feet. The average annual precipitation is about 30 to 40 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 275 to 330 days.

This unit is 45 percent Alambique gravelly loam and 35 percent McGarvey loam.

The Alambique soil is moderately deep and well drained. It formed in material weathered from soft sandstone. Typically, the surface is covered with a mat of decomposed and undecomposed tanoak, madrone, manzanita, and live oak leaves and twigs about 3 inches thick. The surface layer is brown and yellowish red gravelly loam about 12 inches thick. The subsoil is reddish yellow gravelly loam about 18 inches thick. Soft sandstone is at a depth of 30 inches. The depth to bedrock ranges from 20 to 40 inches.

The McGarvey soil is moderately deep and well drained. It formed in material weathered from soft sandstone. Typically, the surface is covered with a mat of decomposed and undecomposed tanoak and redwood leaves and twigs about 4 inches thick. The surface layer is pinkish gray and light brown loam about 7 inches thick. The upper 20 inches of the subsoil is light reddish brown clay loam, and the lower 10 inches is variegated, light reddish brown and reddish brown clay. Soft, fractured sandstone that has silty clay loam in the fractures is at a depth of 37 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of soils that are similar to the Alambique and McGarvey soils but are more than 40 inches deep to bedrock. Also included are small areas of Rock outcrop, soils that are similar to the Alambique soil but are very gravelly throughout the profile or are less than 20 inches deep to bedrock, Maymen soils, soils that are similar to the McGarvey soil but are loamy throughout, and soils that have slopes of less than 30 percent or more than 75 percent. Included areas make up about 20 percent of the total acreage.

Permeability is moderate in the Alambique soil and slow in the McGarvey soil. The available water capacity is low or moderate in both soils. Effective rooting depth is 20 to 40 inches. Runoff is rapid or very rapid, and the hazard of water erosion is high or very high.

This unit is used mainly as wildlife habitat or watershed or for recreational and homesite development. Some areas are used for timber production.

If this unit is used for recreational development, the main limitation is the slope. The slope limits the use of areas of the unit mainly to a few paths and trails, which should extend across the slope. Erosion control should be provided for paths and trails. The plant cover can be maintained by limiting traffic. Cuts and fills should be seeded or mulched.

If this unit is used for homesite development, the main limitations are the slope, depth to bedrock, and slow permeability and high shrink-swell potential of the McGarvey soil. Cuts needed to provide essentially level building sites can expose bedrock. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed. The slope is a concern if septic tank absorption fields are installed. Absorption lines should be installed on the contour. The restricted permeability of the McGarvey soil can be overcome by increasing the size of the absorption field. Properly designing foundations and footings and diverting runoff away from buildings help to prevent the structural damage caused by the high shrink-swell potential in the subsoil of the McGarvey soil.

The McGarvey soil is suited to the production of Douglas fir and redwood. On the basis of a 100-year site curve, the mean site index for Douglas fir is 150. This soil can produce about 12,400 cubic feet, or 54,300 board feet (Scribner rule), of merchantable timber per acre from an even-aged, fully stocked stand of Douglas fir trees 80 years old. On the basis of a 100-year site curve, the mean site index for coastal redwood is 104. The soil can produce about 6,900 cubic feet, or 32,400 board feet (International rule, ¼-inch kerf), of merchantable timber per acre from an even-aged, fully stocked stand of redwood trees 80 years old.

The slope limits the kinds of equipment that can be used in forest management. Tractor logging can be used in the less sloping areas. Highlead or other cable logging can be used in the steeper areas. The use of these methods is limited during November through April. Minimizing the risk of erosion is essential when timber is harvested. Proper design of road drainage systems and care in the placement of culverts help to control erosion. Hand planting of nursery stock generally is necessary to establish or improve a stand. Reforestation must be carefully managed to reduce

competition from undesirable understory plants.

This map unit is in capability subclass VIIe (4), nonirrigated.

105—Barnabe-Candlestick complex, 30 to 75 percent slopes. This map unit is on coastal uplands. Slope is 30 to 75 percent. The native vegetation is mainly low coastal brush, forbs, and annual grasses. Elevation is 200 to 1,350 feet. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 300 to 350 days.

This unit is 45 percent Barnabe very gravelly sandy loam and 35 percent Candlestick fine sandy loam. The Barnabe soil is mainly on or near ridgetops and on the steeper side slopes, and the Candlestick soil is mainly on side slopes and toe slopes. The two soils are so intricately intermingled that it was not practical to map them separately at the scale used.

The Barnabe soil is very shallow and shallow and is well drained. It formed in material weathered from hard, fractured sandstone. Typically, this soil is dark grayish brown very gravelly sandy loam about 12 inches thick. Hard, fractured sandstone is at a depth of 12 inches. In some areas the surface layer is gravelly loam. The depth to bedrock ranges from 8 to 20 inches.

The Candlestick soil is moderately deep and well drained. It formed in material weathered from hard, fractured sandstone. Typically, the surface layer is 14 inches thick. The upper part is brown fine sandy loam, and the lower part is brown loam. The subsoil is pale brown sandy clay loam about 10 inches thick. Hard, fractured sandstone is at a depth of 24 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Kron and Buriburi soils, Rock outcrop, and Candlestick Variant soils. Also included are small areas of soils that have slopes of less than 30 percent or more than 75 percent and small areas of soils that are less than 8 inches deep to hard sandstone and are loam, gravelly loam, or very gravelly loam. Also included in some areas of this unit, on the lower side slopes of San Bruno Mountain, are soils that are sandy loam or gravelly sandy loam 60 inches thick or more. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Barnabe soil and moderately slow in the Candlestick soil. The available water capacity is very low in the Barnabe soil and low or moderate in the Candlestick soil. Effective rooting depth is 8 to 20 inches in the Barnabe soil and 20 to 40 inches in the Candlestick soil. Runoff is rapid or very rapid in both soils, and the hazard of water erosion is high or very high. The Candlestick soil is highly susceptible to slippage when it is wet.

This unit is used mainly as watershed, wildlife habitat, or recreation areas. Most of the unit is in the San Francisco Water District and on San Bruno Mountain.

If this unit is used for recreational development, the main limitations are the slope, the susceptibility of the Candlestick soil to slippage, and the restricted depth of the Barnabe soil. The slope limits the use of areas of the unit mainly to a few paths and trails, which should extend across the slope. Runoff should be diverted to prevent erosion of paths and trails. The plant cover can be maintained by limiting traffic. Cuts and fills should be seeded or mulched.

This map unit is in capability subclass VIIe (15), nonirrigated.

106—Barnabe-Rock outcrop complex, 15 to 75 percent slopes. This map unit is on coastal uplands. Slope is 15 to 75 percent. The native vegetation is mainly low coastal brush and forbs with scattered annual grasses. Elevation is 300 to 850 feet. The average annual precipitation is about 20 to 30 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 300 to 350 days.

This unit is 40 percent Barnabe very gravelly sandy loam and 40 percent Rock outcrop. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

The Barnabe soil is very shallow and shallow and is well drained. It formed in material weathered from hard, fractured sandstone. Typically, this soil is dark grayish brown very gravelly sandy loam about 12 inches thick over hard, fractured sandstone. In some areas the surface layer is gravelly loam. The depth to bedrock ranges from 8 to 20 inches.

The Rock outcrop consists mainly of exposures of hard, fractured sandstone a few feet in diameter. These areas have little if any soil material.

Included in this unit are small areas of Kron, Buriburi, and Candlestick soils and soils that are similar to the Barnabe soil but are less than 8 inches deep to bedrock or are extremely gravelly sandy loam or very gravelly loamy sand throughout. Also included are small areas of soils that are similar to the Barnabe soil but have a layer of windblown sand of varying thicknesses on the surface and small areas of soils north of Guadalupe Parkway, on San Bruno Mountain, that have slopes of

less than 15 percent. Included soils make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate in the Barnabe soil. The available water capacity is very low. Effective rooting depth is 8 to 20 inches. Runoff is rapid or very rapid, and the hazard of water erosion is high or very high.

This unit is used mainly as wildlife habitat or watershed. It is also used for some recreational and urban development. Most of the unit is in the San Francisco Water District and on San Bruno Mountain.

If this unit is used for recreational development, it is limited mainly by the slope and by the restricted depth and the content of gravel in the Barnabe soil. The slope limits the use of areas of the unit mainly to a few paths and trails, which should extend across the slope. Runoff should be diverted to prevent erosion of paths and trails. The plant cover can be maintained by limiting traffic. Cuts and fills should be seeded or mulched.

If this unit is used for homesite and urban development, it is limited mainly by the slope and by the restricted depth of the Barnabe soil. Cuts needed to provide essentially level building sites can expose bedrock. Excavation for roads and buildings increases the risk of erosion. Only the part of the site that is used for construction should be disturbed. Revegetating disturbed areas around construction sites as soon as possible helps to control erosion. Structures to divert runoff are needed if buildings and roads are constructed.

This map unit is in capability subclass VIIe (15), nonirrigated.

107—Botella loam, 0 to 5 percent slopes. This very deep, well drained soil is on stream terraces and alluvial fans. It formed in alluvium derived from various kinds of rock. Slope is 0 to 5 percent. The native vegetation is mainly annual grasses, forbs, and scattered oak. Elevation is 200 to 300 feet. The average annual precipitation is 15 to 25 inches, the average annual air temperature is 56 to 58 degrees F, and the average frost-free period is 275 to 330 days.

Typically, the surface layer is dark grayish brown loam about 36 inches thick. The upper 13 inches of the subsoil is dark grayish brown clay loam, and the lower part to a depth of 60 inches or more is brown clay loam. In some areas the surface layer is clay loam.

Included in this unit are small areas of soils that are loam or gravelly loam throughout or have a clay subsoil. Also included are small areas of Orthents, cut and fill, and soils that have slopes of more than 5 percent. Included soils make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability is moderate to a depth of 36 inches in the Botella soil and is moderately slow below this depth. The available water capacity is very high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used mainly for irrigated and nonirrigated row crops. It is also used for recreational and urban development.

If this unit is used for irrigated and nonirrigated crops, the main limitation is the slope. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. The use of this method permits an even, controlled application of water and reduces runoff. Water should be applied in amounts sufficient to wet the root zone but small enough to minimize the leaching of plant nutrients. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures conserve moisture and help to maintain fertility and tilth. All tillage should be on the contour or across the slope.

This unit has few limitations for homesite, recreational, or urban development. Plans for homesite development should provide for the preservation of as many trees as possible. Only the part of the site that is used for construction should be disturbed. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees. Mulch and fertilizer also are needed.

This map unit is in capability units IIe-1 (14), irrigated, and IIIe-1 (14), nonirrigated.

108—Botella-Urban land complex, 0 to 5 percent slopes. This map unit is on alluvial fans, old flood plains, and stream terraces. It formed in alluvium derived from various kinds of rock. Slope is 0 to 5 percent. The native vegetation is mainly annual grasses, forbs, and scattered oaks. Elevation is 5 to 400 feet. The average annual precipitation is 15 to 25 inches, the average annual air temperature is 56 to 58 degrees F, and the average frost-free period is 275 to 330 days.

This unit is 45 percent Botella clay loam and 30 percent Urban land. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

The Botella soil is very deep and well drained. It formed in alluvium derived from various kinds of rock. Typically, the surface layer is dark grayish brown clay loam about 6 inches thick. The upper 11 inches of the

subsoil is dark grayish brown clay loam, and the lower part to a depth of 60 inches or more is brown clay loam.

Urban land consists of areas covered by asphalt, concrete, buildings, and other structures. The material covered by these structures consists of soils that are similar to the Botella soil.

Included in this unit are small areas of Orthents, cut and fill, and soils that have slopes of more than 5 percent or are loam or gravelly loam throughout. Also included are small areas of soils that are similar to the Botella soil but have more clay in the subsoil. Included soils make up about 25 percent of the total acreage.

Permeability is moderately slow in the Botella soil. The available water capacity is very high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for urban and recreational development.

This unit has few limitations for homesite and urban development. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

This unit is suited to recreational development. It has few limitations.

The Botella soil is in capability unit IIIe-1 (14), nonirrigated, and the Urban land is in capability class VIII (14).

109—Candlestick-Barnabe complex, 30 to 50 percent slopes. This map unit is on coastal uplands. Slope is 30 to 50 percent. The native vegetation is mainly coastal brush, forbs, and annual grasses. Elevation is 75 to 1,200 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 300 to 350 days.

This unit is 45 percent Candlestick fine sandy loam and 25 percent Barnabe very gravelly sandy loam. The two soils are so intricately intermingled that it was not practical to map them separately at the scale used.

The Candlestick soil is moderately deep and well drained. It formed in material weathered from hard, fractured sandstone. Typically, the surface layer is 14 inches thick. The upper part is brown fine sandy loam, and the lower part is brown loam. The subsoil is pale brown sandy clay loam about 10 inches thick. Hard, fractured sandstone is at a depth of 24 inches. The depth to bedrock ranges from 20 to 40 inches.

The Barnabe soil is very shallow and shallow and is well drained. It formed in material weathered from hard, fractured sandstone. Typically, the soil is dark grayish brown very gravelly sandy loam about 12 inches thick over hard, fractured sandstone. In some areas the surface layer is gravelly loam. The depth to bedrock ranges from 8 to 20 inches.

Included in this unit are small areas of Kron and Buriburi soils; Rock outcrop; Orthents, cut and fill; soils that have slopes of less than 30 percent or more than 50 percent; soils that are less than 8 inches deep to bedrock; and soils that are similar to the Candlestick soil but are redder in color or have a gravelly or clayey subsoil. Also included are small areas of soils that are extremely gravelly throughout and are underlain by hard sandstone at a depth of 20 inches or less and small areas of soils that are underlain by limestone. Included areas make up about 30 percent of the total acreage.

Permeability is moderately slow in the Candlestick soil and moderate in the Barnabe soil. The available water capacity is low or moderate in the Candlestick soil and very low in the Barnabe soil. Effective rooting depth is 20 to 40 inches in the Candlestick soil and 8 to 20 inches in the Barnabe soil. Runoff is rapid on both soils, and the hazard of water erosion is high.

This unit is used mainly as watershed or wildlife habitat. A few areas are used for recreational and urban development.

If this unit is used for recreational development, it is limited mainly by the slope. The slope limits the use of areas of the unit mainly to a few paths and trails, which should extend across the slope. Runoff should be diverted to prevent erosion of paths and trails. Cuts and fills should be seeded or mulched. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining an adequate plant cover. The plant cover can be maintained by limiting traffic.

If this unit is used for homesite and urban development, the main limitations are the slope, the restricted depth of the Barnabe soil, and the susceptibility of the Candlestick soil to slippage. Cuts needed to provide essentially level building sites can expose bedrock. Excavation for roads and buildings increases the risk of erosion. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion. Structures to divert runoff are needed if buildings and roads are constructed.

This map unit is in capability subclass VIe (15), nonirrigated.

110—Candlestick-Kron-Buriburi complex, 30 to 75 percent slopes. This map unit is on coastal uplands. Slope is 30 to 75 percent. The native vegetation is mainly annual grasses, coastal brush, and forbs. Elevation is 200 to 1,350 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 300 to 350 days.

This unit is 40 percent Candlestick fine sandy loam, 25 percent Kron sandy loam, and 20 percent Buriburi gravelly loam. The Candlestick soil is on the lower side slopes and toe slopes, and the Kron and Buriburi soils are on the upper and middle side slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

The Candlestick soil is moderately deep and well drained. It formed in material weathered from hard, fractured sandstone. Typically, the surface layer is 14 inches thick. The upper part is brown fine sandy loam, and the lower part is brown loam. The subsoil is pale brown sandy clay loam about 10 inches thick. Hard, fractured sandstone is at a depth of 24 inches. The depth to bedrock ranges from 20 to 40 inches.

The Kron soil is shallow and well drained. It formed in material derived from hard, fractured sandstone. Typically, the surface layer is brown sandy loam about 3 inches thick. The underlying material to a depth of 14 inches is brown loam. Hard, fractured sandstone is at a depth of 14 inches. The depth to bedrock ranges from 10 to 20 inches.

The Buriburi soil is moderately deep and well drained. It formed in material derived dominantly from hard, fractured sandstone. Typically, the surface is covered with a mat of decomposed and undecomposed leaves and twigs about 2 inches thick. The surface layer is dark grayish brown gravelly loam about 3 inches thick. The underlying material to a depth of 30 inches is grayish brown gravelly loam. Hard, fractured sandstone is at a depth of 30 inches. In some areas the surface layer is loam. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Barnabe soils; Orthents, cut and fill; and Rock outcrop. Also included are small areas of soils that have slopes of less than 30 percent or more than 75 percent, soils that are similar to the Candlestick soil but are more than 40 inches deep to bedrock, soils that are similar to the Buriburi soil but are loam throughout, and Typic Argiustolls. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Candlestick soil and moderate in the Kron and Buriburi soils. The available water capacity is low or moderate in the Candlestick soil, very low in the Kron soil, and low in the Buriburi soil. Effective rooting depth is 20 to 40 inches in the Candlestick and Buriburi soils and 10 to 20 inches in the Kron soil. Runoff is rapid or very rapid on all three soils, and the hazard of water erosion is high or very high. The Candlestick soil is highly susceptible to slippage when it is wet, especially in the steeper areas.

This unit is used for recreational development or as wildlife habitat or watershed. Some areas are used for homesite development.

If this unit is used for recreational development, the main limitations are the slope, the susceptibility of the Candlestick soil to slippage, and the shallowness of the Kron soil. The slope limits the use of areas of the unit mainly to a few paths and trails, which should extend across the slope. Runoff should be diverted to prevent erosion of paths and trails. The plant cover can be maintained by limiting traffic. Cuts and fills should be seeded or mulched.

If this unit is used for homesite development, the main limitations are the slope, the susceptibility of the Candlestick soil to slippage, and the shallowness of the Kron soil. Cuts needed to provide essentially level building sites can expose bedrock. Excavation for roads and buildings increases the risk of erosion. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed. Revegetating disturbed areas around construction sites as soon as possible helps to control erosion.

This map unit is in capability subclass VIIe (15), nonirrigated.

111—Candlestick Variant loam, 2 to 15 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived from various kinds of rock. Slope is 2 to 15 percent. The native vegetation is mainly annual grasses and forbs. Elevation is 25 to 400 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 300 to 350 days.

Typically, the surface layer is dark brown and brown loam about 21 inches thick. The subsoil to a depth of 60 inches or more is yellowish brown clay loam.

Included in this unit are small areas of soils that are similar to the Candlestick Variant soil but have more clay in the subsoil or are loamy throughout. Also included are small areas of soils that are less than 60

inches deep to bedrock or have slopes of more than 15 percent. Included soils make up about 10 percent of the total acreage.

Permeability is moderately slow in the Candlestick Variant soil. The available water capacity is very high. Effective rooting depth is 60 inches or more. Runoff is slow or medium, and the hazard of water erosion is slight or moderate.

This unit is used mainly for recreational development or as wildlife habitat or watershed. Some areas are used for homesite development.

If this unit is used for recreational development, the main limitation is the slope. The slope limits the use of areas of the unit mainly to a few paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining an adequate plant cover. The plant cover can be maintained by limiting traffic. Cuts and fills should be seeded or mulched.

If this unit is used for homesite development, the main limitations are the slope and the moderate shrink-swell potential. The risk of erosion is greater in the steeper areas. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed. Revegetating disturbed areas around construction sites as soon as possible helps to control erosion. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

Buildings and roads should be designed to offset the effects of shrinking and swelling. Shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has a low shrink-swell potential.

This map unit is in capability unit IVe-1 (15), nonirrigated.

112—Candlestick Variant loam, 15 to 30 percent slopes. This very deep, well drained soil is on alluvial fans. It formed in alluvium derived from various kinds of rock. Slope is 15 to 30 percent. The native vegetation is mainly annual grasses and forbs. Elevation is 25 to 400 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 300 to 350 days.

Typically, the surface layer is dark brown and brown loam about 21 inches thick. The subsoil to a depth of 60 inches or more is yellowish brown clay loam.

Included in this unit are small areas of soils that are similar to the Candlestick Variant soil but have more clay in the subsoil or are loamy throughout. Also included are small areas of soils that are less than 60 inches deep to bedrock or have slopes of less than 15 percent or more than 30 percent and small areas of soils that are in drainageways and are shallow and stony. Included soils make up about 10 percent of the total acreage.

Permeability is moderately slow in the Candlestick Variant soil. The available water capacity is very high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for recreational development or as wildlife habitat or watershed. Some areas are used for homesite development.

If this unit is used for recreational development, the main limitation is the slope. The slope limits the use of areas of the unit mainly to a few paths and trails, which should extend across the slope. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining an adequate plant cover. The plant cover can be maintained by limiting traffic. Cuts and fills should be seeded or mulched.

If this unit is used for homesite development, the main limitations are the slope and the moderate shrink-swell potential. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed. Revegetating disturbed areas around construction sites as soon as possible helps to control erosion. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

Buildings and roads should be designed to offset the effects of shrinking and swelling. Shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has a low shrink-swell potential.

This map unit is in capability subclass VIe (15), nonirrigated.

113—Fagan loam, 15 to 50 percent slopes. This deep, well drained soil is on uplands. It formed in material weathered from soft sandstone and shale. Slope is 15 to 50 percent. The native vegetation is mainly annual grasses, forbs, and some brush. Elevation is 200 to 2,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 56 to 58 degrees F, and the average frost-free period is 275 to 330 days.

Typically, the surface layer is brown loam over grayish brown clay loam about 19 inches thick. The upper 7 inches of the subsoil is yellowish brown clay loam, and the lower 17 inches is yellowisn brown clay. Soft sandstone and shale are at a depth of 43 inches.

Figure 4.—An area of Fagan loam, 15 to 50 percent slopes.

The depth to bedrock ranges from 40 to 60 inches.

Included in this unit are small areas of soils that are similar to the Fagan soil but are less than 40 inches deep to bedrock, have slopes of less than 15 percent, or have a lighter colored surface layer. Also included are small areas of Obispo and Maymen soils and Rock outcrop. Included areas make up about 15 percent of the total acreage.

Permeability is slow in the Fagan soil. The available water capacity is moderate or high. Effective rooting depth is 40 to 60 inches. Runoff is rapid or very rapid, and the hazard of water erosion is high or very high. The soil is susceptible to slippage when it is wet, especially in the steeper areas.

This unit is used mainly as watershed, recreation areas, or wildlife habitat. Some areas are used for homesite development (fig. 4).

If this unit is used for recreational development, the main limitation is the slope. The slope limits the use of areas of the unit mainly to a few paths and trails, which should extend across the slope. Erosion control should be provided. Cuts and fills should be seeded or

mulched. The plant cover can be maintained by limiting traffic.

If this unit is used for homesite development, the main limitations are the slope, the susceptibility of the soil to slippage, a high shrink-swell potential, and the slow permeability of the subsoil. Cuts needed to provide essentially level building sites can expose bedrock. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed. The slope, the restricted permeability, and the high shrink-swell potential are concerns if septic tank absorption fields are installed. Absorption lines should be installed on the contour. The restricted permeability can be overcome by increasing the size of the absorption field. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has a low shrink-swell potential.

This map unit is in capability subclass VIe (15), nonirrigated.

114—Francisquito-Urban land complex, 5 to 15 percent slopes. This map unit is on terraces. Slope is 5 to 15 percent. The native vegetation is mainly annual grasses and scattered hardwoods. Elevation is 400 to 500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 56 to 58 degrees F, and the average frost-free period is 275 to 330 days.

This unit is 45 percent Francisquito loam and 35 percent Urban land.

The Francisquito soil is very deep and well drained. It formed in alluvium derived from various kinds of rock. Typically, the surface layer is light yellowish brown loam about 16 inches thick. The upper 10 inches of the subsoil is variegated yellowish brown, light yellowish brown, brown, and strong brown clay loam, and the lower part to a depth of 60 inches or more is light yellowish brown, yellowish brown, pale brown, and brown clay.

Urban land consists of areas covered by asphalt, concrete, buildings, and other structures. The material covered by these structures consists of soils that are similar to the Francisquito soil.

Included in this unit are small areas of Botella, Fagan, and Los Gatos soils and Orthents, cut and fill. Also included are small areas of soils that are similar to the Francisquito soil but are underlain by sandstone at a depth of less than 40 inches; loamy soils that are less than 20 inches deep to sandstone; deep, clayey soils that crack upon drying; and dark reddish brown soils that are underlain by metasedimentary rock. Included soils make up about 20 percent of the total acreage.

Permeability is slow in the Francisquito soil. The available water capacity is very high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for homesite development or as watershed or wildlife habitat.

If this unit is used for homesite development, the main limitations are the slow permeability and the high shrink-swell potential in the subsoil of the Francisquito soil. If the soil is used for septic tank absorption fields, the restricted permeability can be overcome by increasing the size of the absorption field. Use of sandy backfill for the trench and longer absorption lines helps to compensate for the restricted permeability. If buildings are constructed on this unit, properly designing the foundations and footings and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has a low shrink-swell potential.

The Francisquito soil is in capability unit IIIe-1 (14), nonirrigated, and the Urban land is in capability class VIII (14).

115—Los Gatos loam, 30 to 75 percent slopes. This moderately deep, well drained soil is on uplands. It formed in material weathered from hard, fractured sandstone. Slope is 30 to 75 percent. The native vegetation is mainly oaks, California laurel, brush, annual grasses, and forbs. Elevation is 200 to 400 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 275 to 330 days.

Typically, the surface layer is dark grayish brown and light yellowish brown loam about 22 inches thick. The subsoil is reddish yellow sandy clay loam about 14 inches thick. Hard, fractured sandstone is at a depth of 36 inches. The depth to sandstone ranges from 20 to 40 inches.

Included in this unit are small areas of Fagan, Maymen, and Obispo soils, Rock outcrop, and Urban land. Also included are small areas of soils that are similar to the Los Gatos soil but have more clay in the subsoil or are very gravelly throughout, soils that have a pale brown or light brownish gray surface layer, loamy soils that are very dark brown throughout, and Orthents, cut and fill. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow in the Los Gatos soil. The available water capacity is low or moderate.

Effective rooting depth is 20 to 40 inches. Runoff is rapid or very rapid, and the hazard of water erosion is high or very high.

Most areas of this unit are used as watershed or wildlife habitat or for recreational development. A few areas are used for homesite development.

If this unit is used for recreational development, the main limitation is the slope. The slope limits the use of areas of the unit mainly to a few paths and trails, which should extend across the slope. Drainage should be provided for paths and trails. Erosion and sedimentation can be controlled and the beauty of the area enhanced by maintaining an adequate plant cover. The plant cover can be maintained by limiting traffic. Cuts and fills should be seeded or mulched.

If this unit is used for homesite development, the main limitations are the slope and the depth to bedrock. Cuts needed to provide essentially level building sites can expose bedrock. Excavation for roads and buildings increases the risk of erosion. Only the part of the site that is used for construction should be disturbed. Plans for homesite development should provide for the preservation of as many trees as possible. Selection of adapted vegetation is critical for the establishment of lawns, shrubs, trees, and vegetable gardens. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees. Mulch and fertilizer are needed to establish lawn grasses and other small-seeded plants.

This map unit is in capability subclass VIIe (15), nonirrigated.

116—Maymen gravelly loam, 30 to 50 percent slopes. This shallow, well drained soil is on uplands. It formed in material weathered from sandstone. Slope is 30 to 50 percent. The native vegetation is mainly brush and scattered hardwoods. Elevation is 400 to 1,200 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 56 to 58 degrees F, and the average frost-free period is 275 to 330 days.

Typically, the surface layer is pale brown gravelly loam about 4 inches thick. The underlying material to a depth of 12 inches is reddish yellow gravelly loam. Sandstone is at a depth of 12 inches. In some areas the surface layer is gravelly sandy loam. The depth to sandstone ranges from 10 to 20 inches.

Included in this unit are small areas of soils that are similar to the Maymen soil but are less than 10 inches deep to bedrock, soils that average more than 35 percent gravel, soils that are gravelly sandy loam throughout, and soils that have slopes of less than 30 percent or more than 50 percent. Also included are small areas of soils that are moderately deep and have a clayey subsoil. Included soils make up about 15 percent of the total acreage.

Permeability is moderate in the Maymen soil. The available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used as watershed or wildlife habitat.

This map unit is in capability subclass VIIe (15), nonirrigated.

117—Novato clay, 0 to 1 percent slopes. This very deep, very poorly drained soil is in saltwater marshes along the edges of San Francisco Bay. It formed in alluvium derived from various kinds of rock. Slope is 0 to 1 percent. The native vegetation is mainly pickleweed, cordgrass, and saltgrass. Elevation is 2 feet below sea level to 5 feet above sea level. The average annual precipitation is 15 to 25 inches, the average annual air temperature is 56 to 58 degrees F, and the average frost-free period is 275 to 330 days.

Typically, the surface layer is gray clay about 6 inches thick. The upper 10 inches of the underlying material is light olive gray clay, and the lower part to a depth of 60 inches or more is gray and dark gray clay. The soil is mottled with jarosite, a sulfidic material, below a depth of 20 inches.

Included in this unit are small areas of soils that are similar to the Novato soil but have been drained and are strongly acid throughout as a result of oxidation of sulfidic material. Also included are small areas of soils that are similar to the Novato soil but have a stratified organic layer. Included soils make up about 10 percent of the total acreage.

Permeability is slow in the Novato soil. The available water capacity is low. Effective rooting depth is 60 inches or more for water- and salt-tolerant plants. Runoff is very slow. The soil is not subject to water erosion. It is subject to tidal flooding. The water level fluctuates from 2 feet above the surface at high tide to 2 feet below the surface at low tide.

This unit is used as wildlife habitat.

This map unit is in capability subclass VIIw (14), nonirrigated.

118—Novato clay, 0 to 1 percent slopes, ponded. This very deep, very poorly drained soil is in saltwater marshes along the edges of San Francisco Bay. It formed in alluvium derived from various kinds of rock. Slope is 0 to 1 percent. The native vegetation is mainly pickleweed, saltgrass, and cordgrass. Elevation is 2 feet

below sea level to 5 feet above sea level. The average annual precipitation is 15 to 25 inches, the average annual air temperature is 56 to 58 degrees F, and the average frost-free period is 275 to 330 days.

Typically, the surface layer is gray and light olive gray clay about 16 inches thick. The upper 14 inches of the underlying material is gray clay, the next 15 inches is dark gray clay, and the lower part to a depth of 60 inches or more is gray clay.

Included in this unit are small areas of Reyes clay and areas where levees of various types of fill material have been constructed. Included areas make up about 5 percent of the total acreage.

Permeability is slow in the Novato soil. The available water capacity is low. Effective rooting depth is 60 inches or more for water- and salt-tolerant plants. Runoff is very slow. The soil is not subject to water erosion.

This unit is used as evaporation ponds for the production of salt.

This map unit is in capability class VIII (14), nonirrigated.

119—Obispo clay, 5 to 15 percent slopes. This shallow, well drained soil is on uplands. It formed in material weathered from hard, serpentinitic rock. Slope is 5 to 15 percent. The native vegetation is mainly annual grasses and forbs with small, scattered areas of brush. Elevation is 100 to 600 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 56 to 58 degrees F, and the average frost-free period is 275 to 330 days.

Typically, the soil is dark gray and very dark gray clay about 12 inches thick over hard, serpentinitic rock. In some areas the soil is clay loam. The depth to bedrock ranges from 10 to 20 inches.

Included in this unit are small areas of Rock outcrop, Urban land, and soils that are shallow or moderately deep, are loam and clay loam, and are underlain by sandstone. Also included are small areas of soils that are similar to the Obispo soil but are less than 10 inches or more than 20 inches deep to bedrock, soils that are neutral or mildly alkaline, soils that have slopes of less than 5 percent or more than 15 percent, and Fagan soils. Included areas make up about 25 percent of the total acreage.

Permeability is slow in the Obispo soil. The available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is slight.

This unit is used mainly as watershed or wildlife habitat. It is also used for urban development.

If this unit is used for urban development, the main limitations are the slope, the shallowness of the soil, a moderate shrink-swell potential (fig. 5), and the slow permeability. Excavation for roads and buildings increases the risk of erosion. Structures to divert runoff are needed if buildings and roads are constructed. The soil is very hard when dry because of the high content of clay. Returning garden residue to the soil helps to improve the nutrient level and porosity of the soil. Topsoil may be needed to establish lawns and gardens.

If this unit is used for septic tank absorption fields, it is limited by the slope, the shallowness of the soil, and the slow permeability. The restricted depth and the slow permeability can be overcome by increasing the size of the absorption field and by using sandy backfill for the trench. The slope is a concern if septic tank absorption fields are installed. Absorption lines should be installed on the contour. The effluent in septic tank absorption fields can surface downslope and thus create a hazard to health.

This map unit is in capability subclass VIIe (15), nonirrigated.

120—Obispo clay, 15 to 30 percent slopes. This shallow, well drained soil is on uplands. It formed in material weathered from hard, serpentinitic rock. Slope is 15 to 30 percent. The native vegetation is mainly annual grasses and forbs with small, scattered areas of brush. Elevation is 100 to 600 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 56 to 58 degrees F, and the average frost-free period is 275 to 330 days.

Typically, the soil is dark gray and very dark gray clay about 12 inches thick over hard, serpentinitic rock. The depth to bedrock ranges from 10 to 20 inches.

Included in this unit are small areas of Rock outcrop, Urban land, and soils that are shallow or moderately deep, are loam and clay loam, and are underlain by sandstone. Also included are small areas of soils that are similar to the Obispo soil but are less than 10 inches or more than 20 inches deep to bedrock, soils that are neutral or mildly alkaline, soils that have slopes of less than 15 percent or more than 30 percent, and Fagan soils. Included areas make up about 25 percent of the total acreage.

Permeability is slow in the Obispo soil. The available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is moderate.

This unit is used mainly as watershed or wildlife habitat. It is also used for urban development.

If this unit is used for urban development, the main

Figure 5.—An area of Obispo clay, 5 to 15 percent slopes. The cracks are a result of shrinking and swelling of the soil.

limitations are the slope, the shallowness of the soil, a moderate shrink-swell potential, and the slow permeability. Excavation for roads and buildings increases the risk of erosion. Structures to divert runoff are needed if buildings and roads are constructed. Preserving the existing plant cover during construction helps to control erosion. Buildings and roads should be designed to offset the effects of shrinking and swelling. Shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has a low shrink-swell potential. The soil is very hard when dry because of the high content of clay. Returning garden residue to the soil helps to improve the nutrient level and porosity of the soil. Topsoil may be needed to establish lawns and gardens.

If this unit is used for septic tank absorption fields, it is limited by the slope, the shallowness of the soil, and the slow permeability. The restricted depth and the slow permeability can be overcome by increasing the size of the absorption field and by using sandy backfill for the

trench. The slope is a concern if septic tank absorption fields are installed. Absorption lines should be on the contour. The effluent in septic tank absorption fields can surface downslope and thus create a hazard to health.

This map unit is in capability subclass VIIe (15), nonirrigated.

121—Orthents, cut and fill, 0 to 15 percent slopes. These very shallow to very deep, well drained soils are on alluvial fans, coastal terraces, and hills. The soils formed in alluvium and residuum derived dominantly from hard or soft sandstone. Slope is 0 to 15 percent. Elevation is sea level to 700 feet. The average annual precipitation is 15 to 30 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 275 to 350 days.

This unit consists of soils that have been cut and filled for recreational development, such as the construction of golf courses and ballfields, or for cemeteries. The soils are nearly level to strongly sloping. They vary greatly in thickness and in the texture of the surface layer. Generally, only the upper part of the soil has been graded and moved in areas that have slopes of less than 5 percent. In many areas, mainly those used for golf courses, topsoil has been added.

Included in this unit are deep, dark alluvial soils, in areas adjacent to San Bruno Mountain, that are loam or fine sandy loam throughout. Also included are small areas of Urban land and soils that have slopes of more than 15 percent. Included areas make up about 5 percent of the total acreage.

The properties and characteristics of the soils in this unit are highly variable because of the differences in the kind and amount of fill material used. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used for recreational development or cemeteries.

This unit has few limitations for use as recreation areas and cemeteries. In summer, irrigation is needed for lawns and most ornamental plantings. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants. Topsoil may also be needed to establish lawns and gardens.

This map unit is in capability class VIII (4, 14, 15), nonirrigated.

122—Orthents, cut and fill, 15 to 75 percent slopes. These very shallow to very deep, well drained soils are on uplands. The soils formed in residuum derived dominantly from sandstone. Slope is 15 to 75 percent. Elevation is 0 to 700 feet. The average annual precipitation is 15 to 30 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 275 to 350 days.

This unit consists of soils that have been cut and filled for urban development. The soils are moderately steep to very steep. They vary greatly in thickness and in the texture of the surface layer. The soil material in the steeper areas generally has been cut or removed for the construction of building foundations and roadways, and bedrock commonly is exposed. The areas of fill generally have slopes of less than 30 percent.

Included in this unit are small areas of Urban land and areas of soils that have slopes of less than 15 percent or more than 75 percent. Included areas make up about 5 percent of the total acreage.

The properties and characteristics of the soils in this unit are highly variable because of the differences in the kind and amount of fill material used. Runoff is rapid or very rapid, and the hazard of water erosion is high or very high.

This unit is used for urban development, including support structures for roads and buildings.

Runoff should be diverted to prevent erosion on this unit. Revegetation of cuts and fills reduces the risk of erosion. Mulch, fertilizer, and irrigation are needed to establish vegetation.

This map unit is in capability class VIII (4, 14, 15), nonirrigated.

123—Orthents, cut and fill-Urban land complex, 0 to 5 percent slopes. This map unit is on broad alluvial fans and flood plains. Slope is 0 to 5 percent. Elevation is 10 to 600 feet. The average annual precipitation is 15 to 30 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 275 to 350 days.

This unit is 55 percent Orthents, cut and fill, and 35 percent Urban land. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

The Orthents consist of soils that have been cut and filled for urban development, such as the construction of roads and buildings. These soils are poorly drained to well drained and are nearly level to gently sloping. They dominantly are deep and very deep and are loam or clay loam. In most areas the texture of the surface layer varies greatly because the upper part of the profile has been graded and moved or fill material has been added.

Urban land consists of areas that are covered by

asphalt, concrete, buildings, and other structures. The material covered by these structures consists of soils that are similar to the Orthents.

Included in this unit are small areas of Orthents, cut and fill, that have slopes of more than 5 percent. Included soils make up about 10 percent of the total acreage.

The properties and characteristics of the Orthents are highly variable because of the differences in the kind and amount of fill material used. Runoff is slow, and the hazard of water erosion is slight.

Most areas of this unit are used for homesite and urban development. A few areas are used for recreational development.

This unit has few limitations for homesite and urban development. In summer, irrigation is needed for lawns and most ornamental plantings. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants. Topsoil may also be needed to establish lawns and gardens.

Excavation for roads and buildings increases the risk of erosion. Revegetating disturbed areas around construction sites as soon as possible helps to control erosion.

This map unit is in capability class VIII (14, 15), nonirrigated.

124—Orthents, cut and fill-Urban land complex, 5 to 75 percent slopes. This map unit is on uplands. Slope is 5 to 75 percent. Elevation is 20 to 800 feet. The average annual precipitation is 15 to 30 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 275 to 350 days.

This unit is 50 percent Orthents, cut and fill, and 35 percent Urban land. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

The Orthents consist of soils that have been cut and filled for urban development. These soils are gently rolling to very steep. They vary greatly in thickness and in the texture of the surface layer. Extensive terraces have been constructed on the side slopes for use as building foundations and road bases and to control runoff. Cuts and fills that have slopes of about 30 to 100 percent separate level areas at different elevations; however, the average slope of the landscape generally is 5 to 75 percent. Generally, only the upper part of the profile has been graded and moved in areas that have slopes of less than 15 percent. The soils in the steeper areas generally have been cut or removed, and bedrock commonly is exposed.

Urban land consists of areas that are covered by asphalt, concrete, buildings, and other structures. The material covered by these structures consists of soils that are similar to the Orthents.

Included in this unit are small areas of Fagan and Obispo soils in the Hillsborough, Belmont, and Burlingame areas along California Highway 280; Maymen soils that are in the Belmont and San Carlos areas and support brush; Los Gatos soils that are in the Belmont and San Carlos areas and support hardwoods; Botella soils on the lower side slopes of alluvial fans and stream terraces; and Francisquito soils on old dissected terraces, mainly along Alameda de las Pulgas. Included soils make up about 15 percent of the total acreage.

The properties and characteristics of the Orthents are highly variable because of the differences in the kind and amount of fill material used. Runoff is medium to very rapid, and the hazard of water erosion is moderate to very high.

Most areas of this unit are used for homesite development.

If this unit is used for homesite and urban development, the main limitations are the slope and the restricted soil depth in some areas. Cuts needed to provide essentially level building sites can expose bedrock. It is difficult to establish plants in areas where the surface layer has been removed. Mulch and fertilizer are needed in these areas. In summer, irrigation is needed for lawns and most ornamental plantings. Topsoil may also be needed to establish lawns and gardens.

Excavation for roads and buildings increases the risk of erosion. Structures to divert runoff are needed if buildings and roads are constructed. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Revegetating disturbed areas around construction sites as soon as possible helps to control erosion.

This map unit is in capability class VIII (14, 15), nonirrigated.

125—Pits and Dumps. This map unit consists of gravel pits, refuse dumps, and rock quarries. Major quarries are in Pacifica, near Rockaway Beach, and on San Bruno Mountain, west of Brisbane. Sanitary landfills are in Daly City, near Mussel Rock and along El Camino Real, and along San Francisco Bay, in San Mateo and Redwood City. A few small gravel pits are throughout the unit.

This unit typically is barren and has little value for agricultural uses.

This map unit is in capability class VIII, nonirrigated.

Figure 6.—An area of Reyes clay, 0 to 1 percent slopes. Wide cracks form when the soil is drained and reclaimed.

126—Reyes clay, 0 to 1 percent slopes. This very deep, somewhat poorly drained soil is on reclaimed tidelands that were once used as evaporation ponds for the production of salt (fig. 6). The soil formed in alluvium derived from various kinds of rock. Slope is 0 to 1 percent. The native vegetation is mainly hydrophytic plants. Elevation is 2 feet below sea level to 5 feet above sea level. The average annual precipitation is 15 to 25 inches, the average annual air temperature is 56 to 58 degrees F, and the average frost-free period is 275 to 330 days.

Typically, the soil is gray clay to a depth of 60 inches or more. In some areas it is silty clay. The soil is mottled with jarosite, a sulfidic material, between depths of 20 and 40 inches.

Included in this unit are small areas of soils that are similar to the Reyes soil but do not contain sulfidic material or are very poorly drained. Also included are small areas of soils that are stratified with organic material or that have slopes of more than 1 percent. Included soils make up about 10 percent of the total acreage.

Permeability is slow in the Reyes soil. The available water capacity is very high for salt-tolerant plants and low for nonsalt-tolerant plants. Effective rooting depth is 60 inches or more for water-tolerant plants but is limited

Figure 7.—"Devils Slide," in an area of Rock outcrop-Orthents complex, 30 to 75 percent slopes.

to a depth of 3 to 5 feet for nonwater-tolerant plants. A fluctuating water table is at a depth of 3 to 5 feet. Runoff is very slow to ponded. The soil is not subject to water erosion.

This unit is used as wildlife habitat.

This map unit is in capability subclass IVw (14), nonirrigated.

127—Rock outcrop-Orthents complex, 30 to 75 percent slopes. This map unit consists mainly of long and narrow, generally rocky areas that rise abruptly along the coastline of the Pacific Ocean (fig. 7). It is made up of cliff faces and associated narrow areas on the top of bluffs that separate the coastal terraces and mountainous uplands from the beaches and ocean. A

few areas are on hilltops in urbanized areas. Slope is 30 to 75 percent. The native vegetation is mainly scattered coastal shrubs, grasses, and forbs on the Orthents and lichens on the Rock outcrop. Elevation is sea level to 650 feet. The average annual precipitation is 15 to 30 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 300 to 350 days.

This unit is 45 percent Rock outcrop and 45 percent Orthents.

The Rock outcrop consists of exposures of sandstone, shale, and basic igneous rock.

The Orthents consist mainly of areas of mixed alluvium of varying depths, areas of loamy soils that are less than 10 inches thick, and pockets of windblown sand.

Included in this unit are small areas of Miramar, Scarper, and Sirdrak soils and Typic Argiustolls. Also included are small areas of Urban land. Included areas make up about 10 percent of the total acreage.

Occasionally parts of the cliff faces in some areas of this unit slough away, causing damage to adjacent urban developments.

This unit is used as wildlife habitat.

This map unit is in capability class VIII (14, 15), nonirrigated.

128—Scarper-Miramar complex, 30 to 75 percent slopes. This map unit is on coastal uplands. Slope is 30 to 75 percent. The native vegetation is mainly coastal shrubs with scattered annual grasses and forbs. Elevation is 200 to 1,800 feet. The average annual precipitation is 20 to 45 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 300 to 350 days.

This unit is 40 percent Scarper gravelly coarse sandy loam and 35 percent Miramar loam. The two soils are so intricately intermingled that it was not practical to map them separately at the scale used.

The Scarper soil is moderately deep and well drained. It formed in material weathered from quartz-diorite. Typically, the surface layer is dark grayish brown and very dark grayish brown gravelly coarse sandy loam about 16 inches thick. The underlying material to a depth of 25 inches is brown gravelly coarse sandy loam. Soft bedrock is at a depth of 25 inches. The depth to bedrock ranges from 20 to 40 inches.

The Miramar soil is moderately deep and well drained. It formed in material derived dominantly from quartz-diorite. Typically, the surface layer is dark grayish brown loam about 15 inches thick. The upper 9 inches of the subsoil is brown clay loam, and the lower 5 inches is yellowish brown loam. Soft bedrock is at a depth of 29 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in this unit are small areas of Rock outcrop; Orthents, cut and fill; and Urban land. Also included are small areas of soils that have slopes of less than 30 percent, have a clayey subsoil, or are less than 20 inches or more than 40 inches deep to bedrock. Included areas make up about 25 percent of the total acreage.

Permeability is moderately rapid in the Scarper soil and moderately slow in the Miramar soil. The available water capacity is very low or low in the Scarper soil and low or moderate in the Miramar soil. Effective rooting depth is 20 to 40 inches in both soils. Runoff is rapid or very rapid, and the hazard of water erosion is high or very high.

This unit is used as recreation areas, wildlife habitat, or watershed.

If this unit is used for recreational development, the main limitation is the slope. The slope limits the use of areas of the unit mainly to a few paths and trails, which should extend across the slope. Erosion control should be provided for paths and trails. The plant cover can be maintained by limiting traffic. Some areas of this unit are susceptible to debris slides. To help prevent these slides, proper drainage is needed for paths and trails and plant cover should be maintained.

This map unit is in capability subclass VIIe (15), nonirrigated.

129—Sirdrak sand, 5 to 50 percent slopes. This very deep, somewhat excessively drained soil is on coastal dunes. It formed in eolian sand. Slope is 5 to 50 percent. The native vegetation is mainly annual grasses, forbs, and coastal shrubs. Elevation is 20 to 700 feet. The average annual precipitation is 20 to 25 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 300 to 350 days.

Typically, the surface layer is dark brown and dark yellowish brown sand about 17 inches thick. The underlying material to a depth of 60 inches or more is yellowish brown sand.

Included in this unit are small areas of Dune land, beaches, Typic Argiustolls, and soils that are similar to the Sirdrak soil but have sandstone, chert, a cemented layer, a clayey subsoil, or shale at a depth of less than 40 inches. Also included are small areas of Urban land and soils that have slopes of less than 5 percent or more than 50 percent or that are dark brown to a depth

of more than 20 inches. In landscaped areas, mainly in Golden Gate Park, are soils that have a loam, fine sandy loam, or loamy fine sand surface layer. The upper 8 to 14 inches of these soils has been transported from other areas. Included areas make up about 10 percent of the total acreage.

Permeability is rapid in the Sirdrak soil. The available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is moderate or high. The hazard of soil blowing is high.

This unit is used as recreation areas or wildlife habitat.

If this unit is used for recreational development, it is limited mainly by the slope and the hazard of soil blowing. The use of the steeper areas of the unit is limited mainly to a few paths and trails, which should extend across the slope. Erosion can be a problem on foot paths and bridle trails unless runoff is diverted. Foot traffic can disturb existing vegetation and create unwanted paths up and down the slopes. Water is then channeled down the slope, resulting in erosion and a buildup of sediment at the foot of the slope. Areas used for recreation can be protected from soil blowing and dust by maintaining an adequate plant cover. Maintaining the plant cover also helps to control erosion and sedimentation and can enhance the beauty of the area. The plant cover can be maintained by limiting traffic.

This map unit is in capability subclass VIIe (15), nonirrigated.

130—Typic Argiustolls, loamy-Urban land association, 5 to 15 percent slopes. This map unit is on coastal terraces. Slope is 5 to 15 percent. The native vegetation is mainly annual grasses, forbs, and scattered brush. Elevation is 25 to 450 feet. The average annual precipitation is 20 to 30 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 300 to 350 days.

This unit is 50 percent Typic Argiustolls, loamy, and 30 percent Urban land.

Typic Argiustolls, loamy, are deep and well drained. They formed in alluvium derived from coastal sediment. The surface layer is grayish brown and dark grayish brown sandy loam or sandy clay loam 10 to 20 inches thick. The subsoil to a depth of 60 inches or more is clay loam, sandy clay loam, clay, or sandy clay that is 25 to 45 percent clay. The soils that have a higher content of clay are on the lower terraces, mainly north of Montara, and on the lower side slopes of San Bruno Mountain, adjacent to Guadalupe Parkway. The soils that have a lower content of clay are on the higher terraces, mainly south of Montara and in the Presidio area of San Francisco.

Urban land consists of areas covered by asphalt, concrete, buildings, and other structures. The material covered by these structures consists of soils that are similar to the Typic Argiustolls.

Included in this unit are small areas of Candlestick, Candlestick Variant, Miramar, Obispo, Scarper, and Sirdrak soils; Orthents, cut and fill; and soils that have slopes of less than 5 percent or more than 15 percent. Also included are small areas of deep, loamy soils that formed in alluvium derived from quartz-diorite and have a dark grayish brown surface layer that is more than 20 inches thick. Included soils make up about 20 percent of the total acreage.

Permeability is moderately slow or slow in the Typic Argiustolls. The available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for recreational and urban development or as wildlife habitat. Some areas are used for row crops.

If this unit is used for recreational development, it has few limitations.

If this unit is used for homesite and urban development, the main limitation is the moderate to high shrink-swell potential. Buildings and roads should be designed to offset the effects of shrinking and swelling. Shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has a low shrink-swell potential. Drainage is needed if roads and building foundations are constructed. Excavation for roads and buildings increases the risk of erosion. Preserving the existing plant cover during construction helps to control erosion. The plant cover can be established and maintained by applying fertilizer, seeding, mulching, and shaping the slopes. Irrigation is needed to establish lawn grasses and other small-seeded plants. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

If this unit is used for irrigated crops, the main limitations are the slope and the restricted permeability of the subsoil. In summer, irrigation is needed for maximum production of most crops. Sprinkler irrigation is the most suitable method of applying water. The use of this method permits an even, controlled application of water, reduces runoff, and minimizes the risk of erosion. If furrow irrigation is used, runs should be on the contour or across the slope.

The Typic Argiustolls, loamy, are in capability units

IIe-1 (14), irrigated, and IIIe-1 (14), nonirrigated, and the Urban land is in capability class VIII (14).

131—Urban land. This map unit consists of areas where more than 85 percent of the surface is covered by asphalt, concrete, buildings, and other structures. These areas are mostly in the business and industrial districts in the eastern part of the survey area. Slope generally is 0 to 5 percent, but it ranges from 0 to 30 percent. Elevation is 10 to 325 feet. The average annual precipitation is 15 to 30 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 275 to 350 days.

Included in this unit are small areas of Orthents, cut and fill, and Orthents, reclaimed. Included soils make up about 15 percent of the total acreage.

This unit is used for homesite, urban, and recreational development.

This map unit is in capability class VIII (14).

132—Urban land-Orthents, cut and fill complex, 0 to 5 percent slopes. This map unit is on coastal terraces and alluvial fans. Slope is 0 to 5 percent. Elevation is 25 to 500 feet. The average annual precipitation is 15 to 30 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 275 to 350 days.

This unit is 50 percent Urban land and 45 percent Orthents, cut and fill. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Urban land consists of areas that are covered by asphalt, concrete, buildings, and other structures. The material covered by these structures consists of soils that are similar to the Orthents.

The Orthents consist of soils that have been cut and filled for urban development, such as the construction of roads and buildings. These soils are nearly level to gently sloping. They dominantly are deep and are loam or clay loam. In most areas the texture of the upper part of the soils varies greatly because it has been graded and moved or fill material has been added.

Included in this unit are small areas of Botella soils; Orthents, reclaimed; Sirdrak soils; and deep alluvial soils that are loam or fine sandy loam throughout. Also included are small areas of deep, dark alluvial soils that are clay and clay loam throughout and soils that have slopes of more than 5 percent. Included soils make up about 5 percent of the total acreage.

The properties and characteristics of the Orthents are highly variable because of the differences in the kind and amount of fill material used. Runoff is slow, and the hazard of water erosion is slight.

Most areas of this unit are used for homesite and urban development. A few areas are used for recreational development.

If this unit is used for homesite and urban development, it has few limitations. In summer, irrigation is needed for lawns and most ornamental plantings. Excavation for roads and buildings increases the risk of erosion. Revegetating disturbed areas around construction sites as soon as possible helps to control erosion.

If this unit is used for recreational development, it has few limitations.

This map unit is in capability class VIII (14, 15), nonirrigated.

133—Urban land-Orthents, cut and fill complex, 5 to 75 percent slopes. This map unit is on uplands. Slope is 5 to 75 percent. Elevation is 75 to 800 feet. The average annual precipitation is 15 to 30 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 275 to 350 days.

This unit is 50 percent Urban land and 40 percent Orthents, cut and fill. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Urban land consists of areas that are covered by asphalt, concrete, buildings, and other structures. The material covered by these structures consists of soils that are similar to the Orthents.

The Orthents consist of soils that have been cut and filled for homesite and urban development. These soils are gently rolling to very steep. They vary greatly in thickness and in the texture of the surface layer. Extensive terraces have been constructed on the side slopes of uplands; they are used as building foundations and road bases and to control runoff. Cuts and fills that have slopes of about 30 to 100 percent separate level areas at different elevations; however, the average slope of the landscape generally is 5 to 75 percent. Generally, only the upper part of the profile has been graded and moved in areas where slopes are 15 percent or less. The soils in the steeper areas generally have been cut or removed, and bedrock commonly is exposed.

Included in this unit are small areas of Candlestick Variant, Sirdrak, Barnabe, Candlestick, Miramar, and Scarper soils and Obispo, Los Gatos, Fagan, and Maymen soils in areas south of Hillsborough to Palo Alto. Included soils make up about 10 percent of the total acreage.

The properties and characteristics of these soils are

highly variable because of the differences in the kind and amount of fill material used. Runoff is medium to very rapid, and the hazard of water erosion is moderate to very high.

Most areas of this unit are used for homesite development, including the construction of roads and streets. A few areas are used for urban and recreational development.

If this unit is used for homesite and urban development, the main limitations are the slope and the shallowness of the soils in some areas. Cuts needed to provide essentially level building sites can expose bedrock. It is difficult to establish plants in areas where the surface layer has been removed. Mulch and fertilizer are needed in these areas. Topsoil may also be needed to establish lawns and gardens. In summer, irrigation is needed for lawns and most ornamental plantings.

Excavation for roads and buildings increases the risk of erosion. Structures to divert runoff are needed if buildings and roads are constructed. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Revegetating disturbed areas around construction sites as soon as possible helps to control erosion.

This map unit is in capability class VIII (14, 15), nonirrigated.

134—Urban land-Orthents, reclaimed complex, 0 to 2 percent slopes. This map unit is in areas that were once part of San Francisco Bay and adjacent tidal flats. Elevation is 0 to 50 feet. The average annual precipitation is 15 to 30 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free period is 275 to 350 days.

This unit is about 65 percent Urban land and 30 percent Orthents, reclaimed.

Urban land consists of areas covered by aspnalt, concrete, buildings, and other structures. The material covered by these structures consists of soils that are similar to the Orthents.

The Orthents consist of soils in areas that have been filled. These soils are very deep and are poorly drained and somewhat poorly drained. They vary greatly in texture. They are made up of soil material, gravel, broken cement and asphalt, bay mud, and solid waste material.

Included in this unit are small areas of Reyes clay, Novato clay, and Orthents, cut and fill. Included soils make up about 5 percent of the total acreage.

The properties and characteristics of these soils are highly variable because of the differences in the kind and amount of fill material used. Some areas have a permanent high water table at a depth of 30 to 60 inches because of the fluctuating tides. Runoff is slow, and the hazard of water erosion is low.

This unit is used for homesite, urban, and recreational development.

If this unit is used for urban and recreational development, the main limitations are the susceptibility of the soils to subsidence and the highly variable soil properties, including texture, permeability, and available water capacity. A high water table is also a limitation in some areas. Areas of fill are not suitable for use as a base for structures until sufficient time has passed for compaction to take place naturally or unless the areas have been compacted mechanically so that the potential for subsidence is minimized. In areas that are to be landscaped, suitable topsoil should be added. Gravel or other debris should be removed from disturbed areas that are to be landscaped, particularly areas that are to be used for lawns. Because of the high water table, shallow-rooted, salt-tolerant trees and shrubs should be planted. Mulch and fertilizer are needed to establish and maintain landscaped areas. In summer, irrigation is needed for lawns and most ornamental plantings.

This map unit is in capability class VIII (14, 15), nonirrigated.

135—Urban land-Orthents, smoothed complex, 5 to 50 percent slopes. This map unit is on coastal terraces, hills, and ridgetops (fig. 8). Slope is 5 to 50 percent. Elevation is 100 to 500 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 300 to 350 days.

This unit is 65 percent Urban land and 25 percent Orthents, smoothed. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Urban land consists of areas that are covered by asphalt, concrete, buildings, and other structures. The material covered by these structures consists of soils that are similar to the Orthents.

The Orthents consist mainly of well drained, gently rolling to steep soils that have been cut and filled for homesite and urban development. These soils vary greatly in thickness. The fill material in these soils formed in soft sandstone of old marine sediment, and it generally is fine sandy loam or loam. Extensive terraces have been constructed on the sides of hills; they are used as building foundations and road bases and to control runoff. Many large areas that were once rolling hills have been smoothed with landgrading equipment

Figure 8.—An area of Urban land-Orthents, smoothed complex, 5 to 50 percent slopes, in center and background. Barnabe soils are on ridges and Candlestick soils are in swales in the foreground.

for use as homesites. Cuts and fills that have slopes of about 15 to 75 percent separate level areas at different elevations; however, the average slope of the landscape is 5 to 50 percent. Only the upper part of the profile has been graded and moved in areas that have slopes of 15 percent or less. The soils on the steeper side slopes generally have been cut or removed, and bedrock commonly is exposed.

Included in this unit are small areas of soils that are similar to the Orthents, smoothed, but are loamy sand or silty loam throughout or have slopes of less than 5 percent or more than 50 percent. Included soils make

up about 10 percent of the total acreage.

Runoff is medium to rapid in the Orthents, and the hazard of water erosion is moderate or high.

Most areas of this unit are used for homesite development or for the construction of roads and streets. A few areas are used for other urban and recreational development.

If this unit is used for homesite and urban development, the main limitations are the slope and the depth to soft bedrock. Cuts needed to provide essentially level building sites can expose bedrock. It is difficult to establish plants in areas where the surface layer has been removed and the bedrock is exposed. Mulch and fertilizer are needed in these areas. Topsoil may also be needed to establish lawns and gardens. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

Excavation for roads and buildings increases the risk of erosion. Structures to divert runoff are needed if buildings and roads are constructed. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Revegetating disturbed areas around construction sites as soon as possible helps to control soil blowing and erosion.

This map unit is in capability class VIII (14, 15), nonirrigated.

136—Urban land-Sirdrak complex, 2 to 50 percent slopes. This map unit is on stabilized dunes. Slope is 2 to 50 percent. The native vegetation is mainly annual grasses, forbs, and coastal shrubs. Elevation is 10 to 800 feet. The average annual precipitation is 15 to 25 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 300 to 350 days.

This unit is 45 percent Urban land and 35 percent Sirdrak sand.

Urban land consists of areas covered by asphalt, concrete, buildings, and other structures. The material covered by these structures consists of soils that are similar to the Sirdrak soil.

The Sirdrak soil is very deep and somewhat excessively drained. It formed in eolian material derived dominantly from beach sand. Typically, the surface layer is dark brown and dark yellowish brown sand about 17 inches thick. The underlying material to a depth of 60 inches or more is yellowish brown sand. In some areas the surface layer is loamy sand. In many landscaped areas, the upper 8 to 14 inches of the profile has been added. It is loam, fine sandy loam, sandy loam, or loamy fine sand.

Included in this unit are small areas of soils that are similar to the Sirdrak soil but are underlain by sandstone, shale, or chert at a depth of less than 40 inches and generally are in the steeper areas of hills. Also included are small areas of soils that have slopes of less than 2 percent or more than 50 percent. Included soils make up about 20 percent of the total acreage.

Permeability is rapid in the Sirdrak soil. The available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is very slow, and the hazard of water erosion is moderate or high. The hazard of soil blowing is high.

This unit is used for homesite and urban development.

If this unit is used for homesite and urban development, the main limitations are the slope, the low available water capacity, and the hazard of soil blowing. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Excavation for houses and access roads in places exposes material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as possible helps to control soil blowing. In summer, irrigation is needed for lawn grasses and most ornamental plants and trees.

This map unit is in capability subclass VIIe (15), nonirrigated.

137—Zeni-Zeni Variant gravelly loams, 30 to 75 percent slopes. This map unit is on uplands. Slope is 30 to 75 percent. The native vegetation is mainly hardwoods, shrubs, and scattered conifers. Elevation is 300 to 1,100 feet. The average annual precipitation is 30 to 45 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free period is 275 to 330 days.

This unit is about 40 percent Zeni gravelly loam and 35 percent Zeni Variant gravelly loam. The two soils are so intricately intermingled that it was not practical to map them separately at the scale used.

The Zeni soil is moderately deep and well drained. It formed in material weathered from sandstone. Typically, the surface is covered with a mat of leaves and twigs about ½ inch thick. The surface layer is pale brown gravelly loam about 9 inches thick. The upper 9 inches of the subsoil is reddish yellow gravelly clay loam, and the lower 8 inches is very pale brown gravelly clay loam. Sandstone is at a depth of 26 inches. The depth to bedrock ranges from 20 to 40 inches.

The Zeni Variant soil is moderately deep and well drained. It formed in material weathered from metasedimentary rock. Typically, the surface is covered

with a mat of partially decomposed and undecomposed leaves and twigs about 1 inch thick. The surface layer is very dark grayish brown and dark grayish brown gravelly loam about 13 inches thick. The upper 18 inches of the subsoil is pale brown and very pale brown very gravelly clay loam, and the lower 8 inches is light yellowish brown gravelly clay loam. Hard, fractured metasedimentary rock is at a depth of 39 inches. The depth to bedrock ranges from 20 to 40 inches.

Included in th's unit are small areas of Alambique and Maymen soils and soils that are similar to the Zeni soil but have more clay in the subsoil. Also included are small areas of soils that have slopes of less than 30 percent and are more than 40 inches deep to bedrock. Included soils make up about 25 percent of the total acreage.

Permeability is moderate in the Zeni soil and moderately slow in the Zeni Variant soil. The available water capacity is low or moderate in both soils. Effective rooting depth is 20 to 40 inches. Runoff is rapid or very rapid, and the hazard of water erosion is high or very high.

This unit is used as watershed or wildlife habitat.

This map unit is in capability subclass VIIe (4), nonirrigated.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. Such land has soil qualities that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. Adequate moisture and a sufficiently long growing season are required. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland may presently be in use as cropland, pasture, or woodland, or it may be in other uses. It either is used for producing food and fiber or is available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water control structures. Public land is land not available for farming in national forests, national parks, military reservations, and state parks.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable, and the level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not flooded during the growing season. The slope ranges mainly from 0 to 6 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland soils if the limitations are overcome by drainage, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Soil Conservation Service.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on lands that are less productive than prime farmland.

About 665 acres, or 0.4 percent of the total land area in the survey area, would meet the requirements for prime farmland if an adequate and dependable supply of irrigation water were available. This acreage consists of Botella loam, 0 to 5 percent slopes (map unit 104). The location of this map unit is shown on the detailed soil maps at the back of this publication. Soil qualities that affect use and management are described in the section "Detailed Soil Map Units."

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may a so find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils generally are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of

erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation. In class VIII there are no subclasses because the soils and miscellaneous areas of this class are restricted to use as recreation areas, watershed, or wildlife habitat.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. In class I there are no unit designations because the characteristics are similar for all of the soils. There are no unit designations for class V, VI, VII, and VIII soils and miscellaneous areas because the soils generally are not managed intensively for use as cropland. Capability units generally are designated by adding an Arabic numeral to the subclass symbol, for example, IIIe-1 or IVe-1. The numbers used to designate units within the subclasses are as follows:

0. Indicates limitations caused by stony, cobbly, or gravelly material in the substratum.
1. Indicates limitations caused by slope or by an actual or potential erosion hazard.
2. Indicates a limitation of wetness caused by poor drainage or flooding.
3. Indicates a limitation of slow or very slow permeability caused by a clayey subsoil or a semiconsolidated substratum.
4. Indicates a low available water capacity in sandy or gravelly soils.
5. Indicates limitations caused by a fine textured or very fine textured surface layer.
6. Indicates limitations caused by salt or alkali.
7. Indicates limitations caused by rocks, stones, or cobbles.
8. Indicates that the soil has a very low or low available water capacity because the root zone generally is less than 40 inches deep over massive bedrock.
9. Indicates limitations caused by very low or low fertility, acidity, or toxicity that cannot be corrected by adding normal amounts of fertilizer, lime, or other amendments.

The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Land Resource Areas

In this survey area, capability classification is further refined by designating the land resource area in which the soils in a unit occur. A land resource area is a broad geographic area that has a distinct combination of climate, soils, topography, vegetation, management needs, and kinds of crops that can be grown *(3)*. Parts of three of these nationally designated resource areas are in the survey area. These areas and their number are California Coastal Redwood Belt (4), Central California Coastal Valleys (14), and Central California Coast Range (15). The number of the resource area is given in parentheses after the capability classification in the detailed soil map unit descriptions.

A soil in one resource area may have characteristics that are similar to those of a soil in another resource area and have the same capability symbol, but the climate, the vegetation, suitable crops, and the management practices needed may differ. For example, the moderately deep soils in capability subclass VIe in the California Coastal Redwood Belt are suited to woodland, but those in the Central California Coast Range are suited only to use as rangeland.

Land resource area 4.—The soils in this resource area are in the western part of the survey area, in the Santa Cruz Mountains. They dominantly are steep and very steep. The natural vegetation is mainly Douglas fir, redwood, and shrubs. Elevation ranges from 300 to 2,000 feet. The average annual precipitation is 30 to 45 inches, the average annual air temperature is 54 to 56 degrees F, and the average frost-free season is 275 to 330 days.

Most of the acreage in this resource area is administered by the San Francisco Water District. The soils are used mainly as watershed, wildlife habitat, or recreation areas.

Land resource area 14.—The soils in this resource area are in the eastern part of the survey area. They dominantly are on alluvial fans, flood plains, stream terraces, and tidal marshes. The natural vegetation is mainly annual grasses, forbs, hydrophytic plants, and some brush. Elevation ranges from 2 feet below sea level to 500 feet above sea level. The average annual precipitation is 15 to 35 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free season is 275 to 350 days.

The soils in this resource area are used for urban and recreational development or as evaporation ponds for the production of salt. Most of the soils along the margins of San Francisco Bay have been diked and drained and are used for urban development. The undrained areas along the bay frequently are inundated by tide water.

Land resource area 15.—The soils in this resource area are in the central part of the survey area. They are gently sloping to very steep. The natural vegetation is mainly annual grasses, forbs, hardwoods, and brush. Elevation ranges from 10 to 2,000 feet. The average annual precipitation is 15 to 45 inches, the average annual air temperature is 54 to 58 degrees F, and the average frost-free season is 275 to 350 days.

Most of the soils in this resource area are used for grazing, recreational development, wildlife habitat, urban development, or some crop production. Generally, irrigation water is not available for commercial crop production.

Woodland Management and Productivity

By Sherman J. Finch, forester, Soil Conservation Service.

The major forest cover types in this survey area are Douglas fir, tanoak, Pacific madrone, redwood, California live oak, blue oak, and Digger pine. The principal trees growing naturally in the area are redwood, Douglas fir, California live oak tanoak, Pacific madrone, and California laurel. Other trees in the area include bigleaf maple, California boxelder, California buckeye, white alder, red alder, giant chinquapin, Oregon ash, Fremont cottonwood, black cottonwood, canyon live oak, blue oak, Oregon white oak, California black oak, valley oak, and interior live oak. Also included in San Mateo County is a hybrid of California black oak and interior live oak.

Many additional species of trees have been planted in the survey area. These include Monterey cypress, Monterey pine, and various species of eucalyptus.

About 13,550 acres of this survey area is forest land, most of which is in the San Francisco Water District or the Mid-Peninsula Open Space District. The rest of the forest land in the area is classified as second growth because the trees have been harvested for sawtimber or fuelwood some time in the past. The first reported cutting was as early as the 1790's, in the Woodside area. The growth of San Francisco as a result of the Gold Rush created considerable demand for lumber. Eight sawmills and three shingle mills were operating in the Woodside area in 1859.

Soil, climate, and aspect are all important in determining the species and growth rate of trees in a particular plant community. Redwood generally grows near the ridgetops and in moist areas such as draws and sheltered alluvial flats. Fog drip from the trees adds moisture to the soil, but the actual amounts are not recorded.

Redwood trees grow best and are largest in small, narrow areas of alluvial soils adjacent to streams. Redwood and Douglas fir grow in areas of deeper soils where the specific climatic requirements for each species are met. Trees in these areas have the greatest growth potential because the soils retain more moisture for a longer period of time.

East of the conifer zone there are two major oak cover types. These are the California live oak and the blue oak-Digger pine types. The California live oak type is in the moister areas, and the blue oak-Digger pine type is in the drier areas.

Protection of young seedlings from grazing, fire, and insects and diseases is needed if the forests in the area are to flourish.

Forest management practices such as protection from wildfire, proper location and maintenance of access roads, drainage, and prompt reforestation after disturbance are needed. Erosion control is also essential. Competition from brush or grass must be controlled to achieve successful plantings of trees.

Recreation

Demand for recreational facilities in the survey area is high because so much of the area is urbanized. Golden Gate National Recreation Area and county parks, including Huddart Park and Wunderlich Park, provide recreational opportunities. Information in this soil survey can be used to help locate additional areas suitable for recreational facilities.

The soils of the survey area are rated in table 3 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning

recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 3, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties generally are favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 3 can be supplemented by other information in this survey, for example, interpretations for dwellings without basements and for local roads and streets in table 4 and interpretations for septic tank absorption fields in table 5.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

By Glenn Wilcox, biologist, Soil Conservation Service.

The varied and commonly contrasting natural and manmade environments in the survey area provide a wide range of wildlife habitat types that support a diversity of fish and wildlife species. Some of the major habitat types include the coastal strands and beaches, coastal salt marshes, freshwater lakes and ponds, riparian areas, coastal scrub areas, broadleaf woodland, annual grassland, and rural and urban land.

Man's activities have varied effects on wildlife populations. Many kinds of wildlife, such as house sparrows, starlings, and band-tailed pigeon, can tolerate man's activities and actually thrive in close association with man. In contrast, the activities of man have resulted in a loss of suitable habitat for other wildlife and thus have contributed to the decline of some species, such as the endangered California clapper rail and the San Francisco garter snake *(5)*.

Ponds and streams in the area contain several kinds of fish, including trout, largemouth bass, bluegill, minnows, stickleback, and sculpin. Steelhead trout have very limited access to streams from San Francisco Bay because of the natural and manmade obstacles and the small size of the streams. Numerous kinds of amphibians, including frogs, newts, and salamanders, are present in moist and aquatic areas.

Wildlife populations can be influenced by manipulation of their habitat. Reducing essential habitat of undesirable wildlife species or providing needed habitat elements for desirable species can affect the numbers of wildlife in an area.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

Maintaining existing wildlife habitat, such as coastal wetlands and riparian areas, should be a primary goal in managing soils for wildlife. Adapted trees and shrubs

can be planted in odd areas and along roads, fencelines, and field borders to provide food and cover for wildlife. Soils best suited to these plantings are those that are medium textured and at least four feet deep. With the exception of those planted on moist or wet soils, shrubs and trees need adequate irrigation for establishment during the first two years as well as protection from livestock grazing and competing weeds. Shrubs and trees should not be planted unless irrigation water is available or hand watering is feasible. More information on plants suitable for specific wildlife species and proper methods for the establishment of these plants can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from local nurseries.

Additional information on wildlife habitat is presented in the section "General Soil Map Units."

Gardening and Landscaping

By Robert Snieckus, landscape architect, Soil Conservation Service.

Local soil conditions and environmental factors, such as solar orientation, microclimate, shade, wind, and availability of water, should be considered when selecting plants for landscaping and gardening. The purpose of the planting, whether for windbreaks, shade, focal points, privacy screens, food, color, smell, or noise and erosion control, should also be considered. The characteristics and special features of the existing vegetation should be evaluated. These characteristics include kinds of species, whether native, introduced, or exotic; resistance to disease, insects, and toxic substances; plant litter; size at maturity; lifespan; and water requirements. Attention to these factors helps to ensure the success of a landscaping or gardening project.

The soils in general soil map units 1, 2, 4, and 5 are in a coastal plant environment. These soils are influenced by a marine climate, which is characterized by fog, high humidity, and persistent winds. The evapotranspiration rate generally is low in these areas. Temperatures in summer commonly are not high enough to support heat-loving plants. Plants in this environment must contend with salt spray in areas near the coast and with salt air in inland areas.

The soils in general soil map units 3, 6, 7, 8, 9, 10, 11, 12, 13, and 14 are in a coastal foothill plant environment. These soils are also subject to a marine climate, but they receive more rainfall than soils of the coastal plant environment. The evapotranspiration rate, however, is higher on the south- and west-facing slopes that have more intense sun exposure and higher summer temperatures.

In this survey area, landscape plantings should be designed to conserve water. Highly efficient irrigation methods are available. Drip irrigation can be used in many areas. The need for irrigation can be reduced greatly or eliminated by planting drought-tolerant species.

Generally, carefully chosen native trees, shrubs, vines, and ground cover should be planted because they grow well with minimal irrigation water and maintenance. Native plants can be just as functional and beautiful as introduced or exotic species.

Soil characteristics can vary widely within a map unit, especially where there has been considerable soil movement as a result of cutting and filling for urban development. Detailed onsite investigation is needed when a landscape project is designed, particularly in areas of Orthents.

The soils in this survey area have been grouped according to their overall quality for use in gardens and landscaped areas. The soils in group A are of very good quality; B, good; C and D, fair; and E, poor. Soil properties considered in the groupings are ease of tillage, site preparation, and soil manipulation; available water capacity throughout the profile; permeability; drainage class; and the effects of overwatering. Not considered are local variations in frost hazard and in exposure to sun and wind.

For the soils in group B, a lower case letter is added to indicate major soil limitations. The letter *c* indicates that enough clay is present to restrict permeability; *d*, that permeability and root penetration are restricted; and *s*, that permeability is not restricted.

Most of the soils used for gardens and landscaped areas can be improved by annual additions of a large amount of suitable organic matter, particularly the soils in groups B and C. Suitable organic matter includes lawn clippings, leaves, and shredded prunings and commercial manure, bark, peat, and compost.

The gardening and landscaping groups included in the survey area are described in the following paragraphs. All of the soils in a particular group are similar in several major features, but they differ in soil reaction, permeability, available water capacity, depth, texture, and kinds of layers and in other features that affect plant growth.

Group A.—Areas of general soil map unit 7 and units 12, 13, and 14 are in this group. The soils in this group are of very good quality for use in gardens and landscaped areas. Management, site preparation, and tillage are easy. These soils are loamy throughout and

are well drained. Permeability is moderate or moderately slow, and the available water capacity generally is high. These soils have no significant soil-related problems.

Group Bc.—Areas of general soil map units 3, 4, 5, 7, and 9 are in this group. The soils in this group are of good quality for use in gardens and landscaped areas. They have a loam or clay loam surface layer and a clay loam subsoil. They are well drained. The available water capacity is moderate, and permeability is moderately slow. Soil depth generally is 20 to 40 inches. Slope ranges from 4 to 75 percent. Runoff, erosion, irrigation, and site preparation are management concerns. If these soils are tilled and compacted when wet, they become hard, cloddy, and difficult to till and they absorb water slowly. If carefully managed, however, these soils are very productive.

Group Bd.—Areas of general soil map units 3, 6, 7, and 8 are in this group. The soils in this group are of good quality for use in gardens and landscaped areas. They have a loam or clay loam surface layer and a clay subsoil. They are well drained. The available water capacity is moderate, and permeability is slow in the subsoil. Soil depth generally is 20 to 40 inches, but roots can penetrate the lower part of the profile only with difficulty. Slope ranges from 5 to 75 percent. Runoff, erosion, a slippage hazard, irrigation, and site preparation are management concerns. If carefully managed, however, these soils are very productive.

Group Bs.—General soil map unit 2 and areas of units 5, 7, 8, and 9 are in this group. The soils in this group are of good quality for use in gardens and landscaped areas. They are loam, fine sandy loam, or gravelly loam and are well drained. The available water capacity and permeability are moderate. Slope ranges from 5 to 75 percent. Runoff, erosion, irrigation, and site preparation are management concerns. If these soils are tilled and compacted when wet, they become hard, cloddy, and difficult to cultivate and they absorb water slowly.

Group C.—Areas of general soil map units 4, 5, and 6 are in this group. The soils in this group are of fair quality for use in gardens and landscaped areas. They are very gravelly loam, loam, or clay and are well drained. Soil depth commonly is 8 to 20 inches. The available water capacity is low or very low. Permeability is moderate to slow. Slope ranges from 5 to 75 percent. Runoff, erosion, irrigation, and site preparation are management concerns. If these soils are used for deep-rooted trees and shrubs, plant growth is poor unless extensive site preparation is applied or soil material is imported. Drought-resistant varieties should be selected, or the plants should be watered and fertilized frequently and carefully.

Group D.—General soil map unit 1 is in this group. The soils in this group are of fair quality for use in gardens and landscaped areas. They are gravelly coarse sandy loam, sand, or loamy sand and are somewhat excessively drained. The available water capacity is low, and permeability is rapid. These soils are loose and porous. Drought-resistant plants that have an extensive root system should be selected, and irrigation water should be applied at short intervals.

Group E.—General soil map units 10 and 11 are in this group. The soils in this group are somewhat poorly drained to very poorly drained. They are unsuitable for use as gardens and landscaped areas. If these soils are reclaimed, however, shallow-rooted, water-tolerant plants can be planted.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building Site Development, Sanitary Facilities, Construction Materials, and Water Management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to

bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 4 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 5 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 5 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 5 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 5 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported

to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 6 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 6, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the taxonomic unit descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation

of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 7 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage and irrigation.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even more than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 8 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each taxonomic unit under "Taxonomic Units and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates

determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 9 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each taxonomic unit under "Taxonomic Units and Their Morphology."

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of the soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very

high, shrinking and swel ing can cause damage to buildings, roads, and other structures. Special design is often needed

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less tnan 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, more than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (as much as 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion.

Erosion factor T is an estimate of the maximum average rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposit'on. In table 9, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It s a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 10 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a h gh rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in closed depressional areas is considered ponding.

Table 10 gives the estimated frequency of flooding. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable, *rare* that it is unlikely but possible under unusual weather conditions (chance of flooding in any year is 0 to 5 percent), *occasional* that it occurs infrequently under normal weather conditions (chance of flooding in any year is 5 to 50 percent), and *frequent* that it occurs often under normal weather conditions (chance of flooding in any year is more than 50 percent).

The information on flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also cons.dered are local information about the extent and level of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a

saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely gray sh colors or mottles in the soil. Indicated in table 10 are the depth to the seasonal high water table; the kind of water table—that is, *perched* or *apparent*; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 10.

An *apparent* water tab e is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

The numbers in the column "High water table" indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that the water table exists for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock s hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion perta ns to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(9)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 11 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hydraquents (*Hydr*, meaning water, plus *aquent*, the suborder of the Entisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hydraquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, thickness of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, mixed, nonacid, isomesic Typic Hydraquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Taxonomic Units and Their Morphology

In this section, each taxonomic unit recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each unit. A pedon, a small three-dimensional area of soil, that is typical of the unit in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (8)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (9)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the unit.

The map units of each taxonomic unit are described in the section "Detailed Soil Map Units."

Accelerator Series

The Accelerator series consists of deep, well drained soils on gently rolling and rolling uplands. These soils

formed in material weathered from soft sandstone and siltstone. Slope ranges from 5 to 15 percent.

Soils of the Accelerator series are fine-loamy, mixed, thermic Typic Haploxeralfs.

Typical pedon of Accelerator loam, in an area of Accelerator-Fagan association, 5 to 15 percent slopes, near Woodside; 2,000 feet west and 300 feet south of the intersection of Sand Hill Road and California Highway 280 (not sectionalized); Palo Alto 7.5' Quadrangle:

Ap—0 to 4 inches; light gray (10YR 7/1) loam, dark grayish brown (10YR 4/2) moist; few fine distinct reticulate yellowish brown (10YR 5/6) mottles, dark yellowish brown (10YR 4/4) moist; strong fine, medium, and coarse subangular blocky structure; hard, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine and fine tubular and interstitial pores and few coarse tubular pores; strongly acid; abrupt smooth boundary.

A1—4 to 13 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine and fine tubular and interstitial pores and few coarse tubular pores; medium acid; diffuse wavy boundary.

A2—13 to 19 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine tubular and interstitial pores and few coarse tubular pores; medium acid; gradual irregular boundary.

A3—19 to 23 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; few fine distinct brownish yellow (10YR 6/6) mottles; weak fine and medium subangular blocky structure; hard, very friable, nonsticky and nonplastic; few very fine roots; many very fine and fine tubular and interstitial pores; medium acid; clear irregular boundary.

Bt1—23 to 29 inches; light gray (10YR 7/2) clay loam, grayish brown (2.5Y 5/2) moist; common medium distinct reticulate yellow (10YR 7/6) mottles; moderate fine, medium, and coarse subangular blocky and weak coarse prismatic structure; very hard, firm, sticky and plastic; few very fine roots; common very fine and fine tubular and interstitial pores; many moderately thick clay films on ped faces, in pores, and as bridges between mineral grains; medium acid; diffuse wavy boundary.

Bt2—29 to 41 inches; yellow (10YR 7/6) gravelly clay loam, grayish brown (2.5Y 5/2) moist; moderate fine, medium, and coarse subangular blocky structure; very hard, firm, sticky and plastic; common very fine and fine tubular and interstitial pores; 20 percent pebbles 2 to 10 millimeters in diameter; many moderately thick clay films on ped faces, in pores, and as bridges between mineral grains; strongly acid; clear irregular boundary.

Cr—41 inches; soft siltstone and sandstone.

Bedrock is at a depth of 40 to 60 inches. Base saturation is more than 75 percent throughout the profile.

The Ap horizon has color of 10YR 6/2, 6/3, 6/4, 7/1, or 7/2. Moist color is 10YR 3/2, 4/2, 4/3, 5/2, or 5/3.

The Bt horizon has color of 10YR 6/3, 7/1, 7/2, or 7/6 or of 2.5Y 5/6. Moist color is 10YR 4/2, 4/3, 5/2, or 5/6; 2.5Y 4/2, 5/2, or 5/4; or 5Y 5/4. Texture is clay loam, sandy clay loam, gravelly clay loam, or silty clay loam. The lower part of the Bt horizon is 0 to 20 percent gravel.

Alambique Series

The Alambique series consists of moderately deep, well drained soils on uplands. These soils formed in material weathered from soft sandstone. Slope ranges from 15 to 75 percent.

Soils of the Alambique series are fine-loamy, mixed, isomesic Ustic Dystropepts.

Typical pedon of Alambique gravelly loam, in an area of Alambique-McGarvey complex, 30 to 75 percent slopes; 3,500 feet east on Kings Mountain Road from Skyline Boulevard, 100 feet south of Kings Mountain Road, and 325 feet east of overhead transmission line (not sectionalized); Woodside 7.5' Quadrangle:

O—3 inches to 0; decomposed and undecomposed duff consisting of tanoak, madrone, manzanita, and live oak leaves and twigs.

A1—0 to 6 inches; brown (7.5YR 5/4) gravelly loam, reddish brown (5YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few medium and coarse tubular and interstitial pores; 20 percent angular pebbles; 2 to 3 percent manganese concretions on the surface; medium acid; diffuse smooth boundary.

A2—6 to 12 inches; reddish yellow (7.5YR 7/6) gravelly loam, dark brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic;

few very fine, fine, and coarse roots; many fine interstitial pores and few fine tubular pores; 20 percent pebbles; medium acid; diffuse wavy boundary.

Bw1—12 to 22 inches; reddish yellow (7.5YR 7/6) gravelly loam, strong brown (7.5YR 5/6) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and coarse roots; many fine interstitial pores and common fine tubular pores; 35 percent pebbles; few thin clay films on ped faces and as bridges; strongly acid; diffuse irregular boundary.

Bw2—22 to 30 inches; reddish yellow (7.5YR 7/6) gravelly loam, strong brown (7.5YR 5/6) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and coarse roots; many very fine tubular and interstitial pores; 30 percent angular pebbles; few thin clay films on ped faces and as bridges; strongly acid; clear irregular boundary.

Cr—30 inches; weathered sandstone that crushes under pressure when moist.

Bedrock is at a depth of 20 to 40 inches. The content of gravel is 5 to 35 percent throughout the profile. Reaction is medium acid or strongly acid. Base saturation is less than 50 percent throughout the profile. The difference between the mean summer soil temperature and the mean winter soil temperature is less than 9 degrees F.

The A horizon has color of 7.5YR 4/2, 4/4, 5/2, 5/4, or 7/6 or of 10YR 4/2, 4/3, 4/4, 5/2, 5/3, or 5/4. Moist color is 7.5YR 3/2, 3/4, or 4/4 or 10YR 2/2, 3/2, 3/3, or 3/4. The horizon is 9 to 20 inches thick.

The Bw horizon has color of 7.5YR 6/6 or 7/6 or of 10YR 5/6, 6/6, or 7/6. Moist color is 7.5YR 4/6 or 5/6 or 10YR 3/6, 4/6, or 5/6. Texture is loam or gravelly loam.

The Alambique soils on Cahill Ridge, in map unit 103, are taxadjuncts to the Alambique series because they have a lithic contact, which is outside the range for the series. This difference, however, does not significantly affect the use and management of the soils.

Barnabe Series

The Barnabe series consists of very shallow and shallow, well drained soils on coastal uplands. These soils formed in material weathered from hard, fractured sandstone. Slope ranges from 15 to 75 percent.

Soils of the Barnabe series are loamy-skeletal, mixed, isomesic Lithic Haplustolls.

Typical pedon of Barnabe very gravelly sandy loam, in an area of Barnabe-Candlestick complex, 30 to 75 percent slopes, on San Bruno Mountain; 50 feet west on paved road to San Bruno Mountain County Park headquarters, from Radio Road; 100 feet south on dirt road and 10 feet east of dirt road (not sectionalized); San Francisco South 7.5' Quadrangle:

A—0 to 7 inches; dark grayish brown (10YR 4/2) very gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots and few fine and medium roots; common very fine and fine tubular and interstitial pores; 45 percent pebbles; slightly acid; diffuse irregular boundary.

Bw—7 to 12 inches; dark grayish brown (10YR 4/2) very gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; common very fine and fine tubular and interstitial pores; few thin clay films on ped faces; 50 percent pebbles; slightly acid; clear irregular boundary.

R—12 inches; hard, highly fractured sandstone.

Bedrock is at a depth of 8 to 20 inches. The difference between the mean summer soil temperature and the mean winter soil temperature is less than 9 degrees F. The profile averages 35 to 50 percent gravel. Base saturation is more than 50 percent throughout the profile.

The A horizon has color of 10YR 4/2, 5/2, or 5/3. Moist color is 10YR 2/2, 3/2, or 3/3. The horizon is 5 to 10 inches thick. It is slightly acid or medium acid.

The Bw horizon has color of 10YR 4/2, 4/3, 5/2, or 5/3. Moist color is 10YR 2/2, 3/2, or 3/3. The horizon is very gravelly sandy loam or very gravelly loam. It is slightly acid or medium acid.

Botella Series

The Botella series consists of very deep, well drained soils on alluvial fans, old flood plains, and stream terraces. These soils formed in alluvium derived from various kinds of rock. Slope ranges from 0 to 5 percent.

Soils of the Botella series are fine-loamy, mixed, thermic Pachic Argixerolls.

Typical pedon of Botella loam, 0 to 5 percent slopes;

150 feet west of California Highway 280 and 150 feet south of San Francisquito Creek (not sectionalized); Palo Alto 7.5' Quadrangle:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine, medium, and coarse subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few very fine roots; many very fine interstitial pores and common very fine tubular pores; moderately alkaline; diffuse smooth boundary.

A1—6 to 22 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine, medium, and coarse subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores and few fine and coarse tubular pores; moderately alkaline; diffuse smooth boundary.

A2—22 to 36 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine, medium, and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular and interstitial pores; few thin clay films on ped faces and in pores; moderately alkaline; diffuse smooth boundary.

Bt1—36 to 49 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine, medium, and coarse subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine tubular and interstitial pores; few thin clay films on ped faces; moderately alkaline; diffuse smooth boundary.

Bt2—49 to 60 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; many fine faint dark brown (10YR 3/3, moist) mottles; weak fine, medium, and coarse subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine tubular and interstitial pores; few thin clay films on ped faces; moderately alkaline.

Base saturation is more than 75 percent throughout the profile.

The A horizon has color of 10YR 4/1, 4/2, or 5/1. Moist color is 10YR 2/2, 3/1, 3/2, or 3/3. Texture is loam or clay loam.

The Bt horizon has color of 10YR 4/1, 4/2, 5/1, or 5/3. Moist color is 10YR 2/2, 3/2, 3/3, or 4/3. Texture is silty clay loam or clay loam.

The Botella soils in this survey area are taxadjuncts to the Botella series because they are moderately alkaline, which is outside the range for the series. This difference, however, does not significantly affect the use and management of the soils.

Buriburi Series

The Buriburi series consists of moderately deep, well drained soils on coastal uplands. These soils formed in material weathered from hard, fractured sandstone. Slope ranges from 30 to 75 percent.

Soils of the Buriburi series are fine-loamy, mixed, isomesic Pachic Haplustolls.

Typical pedon of Buriburi gravelly loam, in an area of Candlestick-Kron-Buriburi complex, 30 to 75 percent slopes, on San Bruno Mountain; 1,000 feet south on Radio Road from its intersection with Guadalupe Canyon Parkway and 150 feet east of Radio Road (not sectionalized); San Francisco South 7.5' Quadrangle:

O—2 inches to 0; decomposed and undecomposed eucalyptus leaves and twigs and berry vines.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) gravelly loam, dark brown (10YR 3/3) moist; moderate medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine tubular and interstitial pores; 20 percent pebbles 2 to 40 millimeters in diameter; medium acid; clear smooth boundary.

A2—3 to 10 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; many very fine tubular and interstitial pores and few coarse tubular pores; 20 percent pebbles 2 to 40 millimeters in diameter; medium acid; diffuse smooth boundary.

A3—10 to 16 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; many very fine tubular and interstitial pores and few coarse tubular pores; 20 percent pebbles 2 to 40 millimeters in diameter; medium acid; diffuse smooth boundary.

A4—16 to 30 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots and few

medium roots; many very fine and fine tubular and interstitial pores; 25 percent pebbles 2 to 40 millimeters in diameter; medium acid; clear irregular boundary.

R—30 inches; hard, fractured sandstone.

Bedrock is at a depth of 20 to 40 inches. The difference between the mean summer soil temperature and the mean winter soil temperature is less than 9 degrees F. Reaction is medium acid or slightly acid throughout the profile.

The A horizon has color of 10YR 4/2, 4/3, 5/2, or 5/3. Moist color is 10YR 2/2, 3/1, 3/2, or 3/3.

Candlestick Series

The Candlestick series consists of moderately deep, well drained soils on coastal uplands. These soils formed in material weathered from hard, fractured sandstone. Slope ranges from 30 to 75 percent.

Soils of the Candlestick series are fine-loamy, mixed, isomesic Pachic Argiustolls.

Typical pedon of Candlestick fine sandy loam, in an area of Candlestick-Kron-Buriburi complex, 30 to 75 percent slopes, on San Bruno Mountain; 2,100 feet east from the intersection of Guadalupe Canyon Parkway and Radio Road and 100 feet north of Guadalupe Canyon Parkway, on jeep trail (not sectionalized); San Francisco South 7.5' Quadrangle:

A1—0 to 2 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate very fine and fine subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine tubular and interstitial pores; 5 percent pebbles 2 to 40 millimeters in diameter; medium acid; clear smooth boundary.

A2—2 to 14 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine and few coarse tubular and interstitial pores; 5 percent pebbles 2 to 40 millimeters in diameter; medium acid; diffuse smooth boundary.

A3—14 to 20 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine and fine and few coarse tubular and interstitial pores; 5 percent pebbles 2 to 40 millimeters in diameter; slightly acid; clear irregular boundary.

Bt—20 to 24 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; few very fine roots; many very fine and fine interstitial pores and few coarse tubular and interstitial pores; few thin clay films on ped faces, in pores, and as bridges between mineral grains; 5 percent pebbles 2 to 40 millimeters in diameter; slightly acid; clear irregular boundary.

R—24 inches; hard, fractured sandstone.

Bedrock is at a depth of 20 to 40 inches. The profile averages 5 to 15 percent gravel. The difference between the mean summer soil temperature and the mean winter soil temperature is less than 9 degrees F.

The A horizon has color of 10YR 4/2, 4/3, 5/2, or 5/3. Moist color is 10YR 2/2, 3/1, 3/2, or 3/3. Reaction is medium acid or slightly acid.

The Bt horizon has color of 10YR 4/3, 5/3, 5/4, or 6/3. Moist color is 10YR 3/3, 4/3, or 4/4. Texture is sandy clay loam or clay loam. Reaction is slightly acid or neutral.

Candlestick Variant

The Candlestick Variant consists of very deep, well drained soils on alluvial fans. These soils formed in alluvium derived from various kinds of rock. Slope ranges from 2 to 30 percent.

Soils of the Candlestick Variant are fine-loamy, mixed, isomesic Pachic Argiustolls.

Typical pedon of Candlestick Variant loam, 15 to 30 percent slopes, on San Bruno Mountain; 150 feet north from the intersection of Randolph and Franklin Streets (not sectionalized); South San Francisco 7.5' Quadrangle:

A1—0 to 11 inches; dark brown (10YR 4/3) loam, black (10YR 2/1) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine tubular and interstitial pores and few medium and coarse interstitial pores; 5 percent pebbles 2 to 12 millimeters in diameter; medium acid; diffuse smooth boundary.

A2—11 to 21 inches; brown (10YR 5/3) loam, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and

f ne roots; many very fine tubular and interstitial pores and few medium and coarse interstitial pores; 5 percent pebbles 2 to 12 millimeters in diameter; medium acid; clear irregular boundary.

Bt1—21 to 26 inches; yellowish brown (10YR 5/4) clay loam, variegated very dark grayish brown (10YR 3/2) and dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; very hard, friable, sticky and plastic; few fine roots; many very fine tubular and interstitial pores and few medium interstitial pores; few thin clay films on ped faces and in pores; 5 percent pebbles 2 to 5 millimeters in diameter; slightly acid; diffuse smooth boundary.

Bt2—26 to 46 inches; yellowish brown (10YR 5/4) clay loam, variegated dark yellowish brown (10YR 4/4) and ye lowish brown (10YR 5/6) moist; common medium distinct reticulate yellowish brown (10YR 5/6) mottles; common fine distinct very dark grayish brown (10YR 3/2) manganese concretions; moderate fine and medium subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; many very fine tubular and interstitial pores and few medium interstitial pores; common moderately thick clay films on ped faces, in pores, and as bridges between mineral grains; 10 percent pebbles 2 to 5 millimeters in diameter; neutral; diffuse wavy boundary.

Bt3—46 to 65 inches; variegated yellowish brown (10YR 5/4 and 5/6) clay loam, variegated yellowish brown (10YR 5/4 and 5/6) moist; massive; very hard, firm, sticky and plastic; few fine roots; many very fine tubular and interstitial pores and few medium interstitial pores; common moderately thick clay films as bridges between mineral grains; 5 percent pebbles 2 to 5 millimeters in diameter; moderately alkaline.

The solum is more than 60 inches thick. Base saturation is more than 75 percent throughout the profi e. The profile averages 0 to 15 percent gravel.

The A horizon has color of 10YR 4/1, 4/2, 4/3, or 5/3. Moist color is 10YR 2/1, 2/2, 2/3, 3/2, or 3/3.

The Bt horizon has color of 10YR 4/1, 5/2, 5/4, 5/6, or 6/2 or of 7.5YR 6/2. Moist color is 10YR 3/2, 4/3, 4/4, 5/3, 5/4, 5/6, or 5/8. Reaction is slightly acid to moderately alkaline.

Fagan Series

The Fagan series consists of deep, well drained soils on uplands. These soils formed in material weathered dominantly from soft sandstone and shale. Slope ranges from 5 to 50 percent.

Soils of the Fagan series are fine, montmorillonitic, *thermic* Typic Argixerolls.

Typical pedon of Fagan loam, 15 to 50 percent slopes, in the San Francisco Water District; 725 feet south on service road from the intersection of St. James Road and Wemberly Street and 50 feet southwest of first bend in road (not sectionalized); San Mateo 7.5' Quadrangle:

A1—0 to 5 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and few medium roots; many very fine and fine and few medium tubular and interstitial pores; 5 percent pebbles 2 to 20 millimeters in diameter; slightly acid; diffuse smooth boundary.

A2—5 to 11 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium, coarse, and very coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and few medium roots; many very fine and fine and few medium tubular and interstitial pores; 5 percent pebbles 2 to 12 millimeters in diameter; slightly acid; diffuse smooth boundary.

BA—11 to 19 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse angular and subangular blocky structure; hard, friable, sticky and plastic; few very fine and medium roots; many very fine and fine tubular and interstitial pores; few thin clay films on ped faces; 5 percent pebbles 2 to 12 millimeters in diameter; slightly acid; clear irregular boundary.

Bt1—19 to 26 inches; yellowish brown (10YR 5/4) clay loam, variegated dark yellowish brown (10YR 4/4) and very dark grayish brown (10YR 3/2) moist; common fine distinct reticulate grayish brown (10YR 5/2) mottles; moderate coarse angular blocky structure; hard, friable, very sticky and very plastic; few very fine and medium roots; many fine and medium tubular and interstitial pores; few thin clay films on ped faces, in pores, and as bridges between mineral grains; 5 percent pebbles 2 to 75 millimeters in diameter; slightly acid; clear smooth boundary.

Bt2—26 to 36 inches; yellowish brown (10YR 5/4) clay, variegated dark yellowish brown (10YR 4/4) and very dark grayish brown (10YR 3/2) moist; many

medium distinct reticulate grayish brown (10YR 5/2) mottles; moderate coarse angular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; many fine and medium tubular and interstitial pores; few thin clay films on ped faces, in pores, and as bridges between mineral grains; 10 percent pebbles 2 to 20 millimeters in diameter; slightly acid; diffuse smooth boundary.

Bt3—36 to 43 inches; yellowish brown (10YR 5/4) clay, variegated dark yellowish brown (10YR 4/4) and very dark grayish brown (10YR 3/2) moist; many medium distinct reticulate grayish brown (10YR 5/2) mottles; moderate coarse angular blocky structure; very hard, very firm, very sticky and very plastic; many fine and medium tubular and interstitial pores; few thin clay films on ped faces, in pores, and as bridges between mineral grains; 10 percent pebbles 2 to 12 millimeters in diameter; slightly acid; diffuse smooth boundary.

Cr—43 inches; soft, highly weathered sandstone and shale.

Bedrock is at a depth of 40 to 50 inches. Base saturation is more than 75 percent throughout the profile. Reaction is medium acid or slightly acid throughout the profile. The profile averages 0 to 10 percent gravel.

The A horizon has color of 10YR 4/2, 5/2, or 5/3. Moist color is 10YR 3/2 or 3/3.

The Bt horizon has color of 10YR 5/2, 5/3, or 5/4. Moist color is 10YR 3/2, 4/3, or 4/4. Texture is clay loam or clay.

Francisquito Series

The Francisquito series consists of very deep, well drained soils on gently rolling and rolling terraces. These soils formed in mixed alluvium. Slope ranges from 5 to 15 percent.

Soils of the Francisquito series are fine, mixed, thermic Typic Haploxeralfs.

Typical pedon of Francisquito loam, in an area of Francisquito-Urban land complex, 5 to 15 percent slopes, near Woodside; 1,200 feet north on Sand H ll Road from its intersection with Mountain Home Road and 200 feet east of Sand Hill Road (not sectionalized); Palo Alto 7.5' Quadrangle:

Ap—0 to 6 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common very fine roots; many very fine and fine tubular and interstitial pores and few medium tubular pores; slightly acid; clear irregular boundary.

A—6 to 16 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) moist; weak medium and coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine roots; many very fine tubular and interstitial pores and few medium tubular pores; slightly acid; clear irregular boundary.

Bt1—16 to 21 inches; variegated light yellowish brown (10YR 6/4) and brown (7.5YR 4/4) clay loam, dark yellowish brown (10YR 4/4) moist; weak medium and coarse subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few very fine roots; many very fine and fine tubular and interstitial pores; few thin clay films on peds and in pores; slightly acid; clear irregular boundary.

Bt2—21 to 26 inches; variegated yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) clay loam, dark yellowish brown (10YR 4/6) and strong brown (7.5YR 5/6) moist; weak medium and coarse subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few very fine roots; many very fine and fine tubular and interstitial pores; common thin clay films on peds and in pores; slightly acid; clear irregular boundary.

Bt3—26 to 34 inches; variegated light yellowish brown (10YR 6/4) and strong brown (7.5YR 5/6) clay, dark yellowish brown (10YR 4/6) moist; weak coarse subangular blocky structure; extremely hard, firm, slightly sticky and slightly plastic; few very fine roots; many very fine and fine tubular and interstitial pores; many thin clay films on ped faces and in pores; medium acid; clear irregular boundary.

Bt4—34 to 50 inches; variegated pale brown (10YR 6/3) and brown (7.5YR 5/4) clay, brownish yellow (10YR 6/6) and dark brown (7.5YR 4/4) moist; weak coarse subangular blocky structure; extremely hard, firm, slightly sticky and slightly plastic; few very fine roots; many very fine and fine tubular and interstitial pores; many thin clay films on ped faces and in pores; medium acid; clear irregular boundary.

BC—50 to 60 inches; very pale brown (10YR 8/3) clay loam, brownish yellow (10YR 6/6) moist; massive; very hard, slightly sticky and slightly plastic; many very fine and fine tubular and interstitial pores; medium acid.

The solum is 40 to more than 60 inches thick. Base saturation is more than 75 percent throughout the profile.

The A horizon has color of 10YR 6/2, 6/3, 6/4, 7/2, 7/3, or 7/4. Moist color is 10YR 4/2, 4/3, 4/4, 5/2, 5/3, or 5/4. Reaction is slightly acid or medium acid.

The Bt horizon has color of 10YR 5/6, 6/3, 6/4, 6/5, or 6/6 or of 7.5YR 4/4, 5/4, or 5/6. Moist color is 10YR 4/4, 4/6, 5/4, 5/6, or 6/6 or 7.5YR 3/4, 4/4, 4/6, 5/4, or 5/6. The horizon is slightly acid or medium acid. Texture is clay loam or clay.

Kron Series

The Kron series consists of shallow, well drained soils on uplands. These soils formed in material weathered from hard, fractured sandstone. Slope ranges from 30 to 75 percent.

Soils of the Kron series are loamy, mixed, isomesic Lithic Haplustolls.

Typical pedon of Kron sandy loam, in an area of Candlestick-Kron-Buriburi complex, 30 to 75 percent slopes, on San Bruno Mountain; 2,250 feet east on Guadalupe Canyon Parkway from its intersection with Radio Road and 250 feet north of Guadalupe Canyon Parkway along concrete flume (not sectionalized); San Francisco South 7.5' Quadrangle:

A1—0 to 3 inches; brown (10YR 4/3) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and few fine roots; many very fine tubular and interstitial pores; 5 percent pebbles 2 to 20 millimeters in diameter; slightly acid; clear smooth boundary.

A2—3 to 9 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine and few fine roots; few very fine and common fine tubular and interstitial pores; 10 percent pebbles 2 to 40 millimeters in diameter; slightly acid; diffuse smooth boundary.

A3—9 to 14 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate very fine, fine, medium, and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; few very fine tubular and interstitial pores; 5 percent pebbles 2 to 12 millimeters in diameter; medium acid; abrupt smooth boundary.

R—14 inches; hard, fractured sandstone.

Bedrock is at a depth of 10 to 20 inches. Base saturation is more than 75 percent throughout the profile. The difference between the mean summer soil temperature and the mean winter soil temperature is less than 9 degrees F.

The A horizon has color of 10YR 4/2, 4/3, 5/2, or 5/3. Moist color is 10YR 2/2, 3/2, or 3/3. Reaction is medium acid or slightly acid throughout the profile.

Los Gatos Series

The Los Gatos series consists of moderately deep, well drained soils on uplands. These soils formed in material weathered from hard, fractured sandstone. Slope ranges from 30 to 75 percent.

Soils of the Los Gatos series are fine-loamy, mixed, mesic Typic Argixerolls.

Typical pedon of Los Gatos loam, 30 to 75 percent slopes, in the San Francisco Water District; 1,600 feet east on service road from its intersection with Canada Road, across from the Pulgas Water Temple, and 300 feet north of service road (not sectionalized); Woodside 7.5' Quadrangle:

A1—0 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; many fine and medium tubular and interstitial pores; neutral; clear smooth boundary.

A2—10 to 22 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 3/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine, medium, and coarse roots; many fine tubular and interstitial pores; medium acid; clear smooth boundary.

Bt1—22 to 29 inches; reddish yellow (7.5YR 6/6) sandy clay loam, brown (7.5YR 5/4) moist; weak medium and coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and medium roots; many fine and medium tubular and interstitial pores; few thin clay films on ped faces, lining pores, and bridging sand grains; slightly acid; clear irregular boundary.

Bt2—29 to 36 inches; reddish yellow (7.5YR 6/6) sandy clay loam, brown (7.5YR 5/4) moist; weak medium and coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine and medium roots; many fine and medium tubular and interstitial pores; few thin clay films on ped faces, lining pores, and bridging sand grains; slightly acid; abrupt wavy boundary.

R—36 inches; hard, fractured sandstone.

Bedrock is at a depth of 20 to 40 inches. Base saturation is more than 75 percent throughout the profile.

The A1 horizon nas color of 10YR 4/2, 4/3, 5/2, or 5/3 or of 7.5YR 4/2, 4/4, or 5/2. Moist color is 10YR 2/2, 3/2, or 3/3 or 7.5YR 2/2, 3/2, or 4/2. Reaction is medium acid to neutral.

The Bt horizon has color of 7.5YR 5/2, 5/4, 6/2, 6/4, or 6/6 or of 5YR 5/3, 5/4, 5/6, 6/3, 6/4, or 6/6. Moist color is 7.5YR 3/2, 3/4, 4/2, 4/4, 5/4, or 5/6 or 5YR 3/3, 3/4, 4/3, 4/4, or 4/6. Reaction is medium acid to neutral.

Maymen Series

The Maymen series consists of shallow, well drained soils on uplands. These soils formed in material weathered from sandstone. Slope ranges from 30 to 50 percent.

Soils of the Maymen series are loamy, mixed, mesic Dystric Lithic Xerochrepts.

Typical pedon of Maymen gravelly loam, 30 to 50 percent slopes, in the San Francisco Water District; 3,600 feet north on Canada Road from its intersection with Edgewood Road and 1,700 feet east of Canada Road (not sectionalized); Woodside 7.5' Quadrangle:

A—0 to 4 inches; pale brown (10YR 6/3) gravelly loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium and coarse roots; many very fine and fine tubular and interstitial pores; 20 percent pebbles; medium acid; clear smooth boundary.

Bw—4 to 12 inches; reddish yellow (7.5YR 7/6) gravelly loam, strong brown (7.5YR 5/6) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium and coarse roots; many very fine and fine tubular and interstitial pores; 30 percent pebbles; few thin clay films on ped faces and in pores; strongly acid; clear irregular boundary.

R—12 inches; weathered sandstone that crushes under pressure when moist; does not slake in water.

Bedrock is at a depth of 10 to 20 inches. Base saturation below a depth of 10 inches is less than 60 percent. The profile averages 15 to 30 percent gravel.

The A horizon has color of 10YR 4/2, 5/2, 5/3, 6/2, or 6/3 or of 7.5YR 4/4, 5/6, 6/4, or 6/6. Moist color is 10YR 3/2, 3/3, or 4/3 or 7.5YR 4/4 or 5/4. Reaction is medium acid or slightly acid.

The Bw horizon has color of 10YR 6/3, 6/4, or 6/6 or of 7.5YR 5/8, 6/4, 6/6, or 7/6. Moist color is 10YR 4/3, 4/4, 5/4, or 5/6 or 7.5YR 4/4, 5/4, or 5/6. Reaction is strongly acid to slightly acid.

McGarvey Series

The McGarvey series consists of moderately deep, well drained soils on uplands. These soils formed in material weathered from soft sandstone. Slope ranges from 30 to 75 percent.

Soils of the McGarvey series are fine, mixed, isomesic Ultic Tropudalfs.

Typical pedon of McGarvey loam, in an area of Alambique-McGarvey complex, 30 to 75 percent slopes, in Huddart County Park; 2,750 feet north and 700 feet east of the intersection of Skyline Boulevard (Highway 35) and Kings Mountain Road (not sectionalized); Woodside 7.5' Quadrangle:

O1—4 to 3 inches; undecomposed tanoak and redwood leaves and twigs.

O2—3 inches to 0; decomposed tanoak and redwood leaves and twigs.

A1—0 to 3 inches; pinkish gray (7.5YR 6/2) loam, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many coarse roots and few very fine, fine, and medium roots; many very fine and fine tubular and interstitial pores and common medium tubular pores; 10 percent angular pebbles 2 to 5 millimeters in diameter; slightly acid; clear smooth boundary.

A2—3 to 7 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 4/2) moist; moderate fine and medium subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine and fine tubular and interstitial pores and common medium tubular pores; 6 percent angular pebbles 2 to 5 millimeters in diameter; slightly acid; gradual wavy boundary.

Bt1—7 to 14 inches; light reddish brown (5YR 6/4) clay loam, yellowish red (5YR 4/6) moist; moderate medium and coarse subangular blocky structure; extremely hard, firm, slightly sticky and slightly plastic; common coarse roots and many fine and medium roots; common fine and medium tubular and interstitial pores; 2 percent angular pebbles 2 to 5 millimeters in diameter; common thin clay films on ped faces, in pores, and as bridges; neutral; gradual wavy boundary.

Bt2—14 to 27 inches; light reddish brown (5YR 6/4)

clay loam, brown (7.5YR 5/4) moist; moderate medium and coarse subangular blocky structure; extremely hard, firm, sticky and plastic; many coarse roots and common fine and medium roots; common fine and medium tubular and interstitial pores; 3 percent angular pebbles 2 to 5 millimeters in diameter; common thin clay films on ped faces, in pores, and as bridges; neutral; gradual wavy boundary.

Bt3—27 to 37 inches; variegated light reddish brown (5YR 6/3) and reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate medium and coarse subangular blocky structure; extremely hard, firm, sticky and plastic; many coarse roots and few fine and medium roots; common very fine and fine tubular and interstitial pores; 3 percent angular pebbles 2 to 5 millimeters in diameter; common thin clay films on ped faces and in pores; slightly acid; clear wavy boundary.

Cr—37 inches; soft, fractured sandstone; silty clay loam in fractures.

Bedrock is at a depth of 20 to 40 inches. The profile averages 0 to 10 percent gravel. Reaction is slightly acid or neutral throughout the profile. The difference between the mean summer soil temperature and the mean winter soil temperature is less than 9 degrees F.

The A horizon has color of 7/5YR 6/2, 6/3, or 6/4. Moist color is 7/5YR 3/2, 4/2, or 4/4.

The Bt horizon has color of 5YR 5/4, 6/3, or 6/4. Moist color is 5YR 4/4 or 4/6 or 7.5YR 4/6 or 5/4. Texture is clay loam or clay.

Miramar Series

The Miramar series consists of moderately deep, well drained soils on coastal uplands. These soils formed in material weathered from quartz-diorite. Slope ranges from 30 to 75 percent.

Soils of the Miramar series are fine-loamy, mixed, isomesic Pachic Argiustolls.

Typical pedon of Miramar loam, in an area of Scarper-Miramar complex, 30 to 75 percent slopes; about 0.5 mile north of Montara, on California Highway 1; 1,400 feet north and 750 feet east of the intersection of Highway 1 and Martini Creek (not sectionalized); Montara Mountain 7.5' Quadrangle:

A1—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; strong fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; many very fine and fine tubular and interstitial pores; 5 percent pebbles 2 to 7 millimeters in diameter; neutral; clear wavy boundary.

A2—7 to 15 inches; dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; moderate coarse subangular blocky structure parting to moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common very fine tubular and interstitial pores; 5 percent pebbles 2 to 5 millimeters in diameter; slightly acid; clear wavy boundary.

Bt—15 to 24 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and plastic; few very fine and fine roots; common very fine tubular pores; 5 percent pebbles 2 to 5 millimeters in diameter; slightly acid; clear wavy boundary.

BC—24 to 29 inches; yellowish brown (10YR 5/4) loam, dark brown (10YR 4/3) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and plastic; few very fine and fine roots; common very fine tubular pores; 5 percent pebbles 2 to 5 millimeters in diameter; slightly acid; clear wavy boundary.

Cr—29 inches; weathered quartz-diorite that slakes in water.

Bedrock is at a depth of 20 to 40 inches. The profile averages 2 to 10 percent gravel. Reaction is slightly acid or neutral throughout the profile. The difference between the mean summer soil temperature and the mean winter soil temperature is less than 9 degrees F.

The A1 horizon has color of 10YR 3/2, 4/2, or 5/2. Moist color is 10YR 2/1, 2/2, 3/1, or 3/2.

The Bt horizon has color of 10YR 3/4, 5/3, 5/4, or 5/6. Moist color is 10YR 3/2 or 3/3. Texture is sandy clay loam or clay loam.

Novato Series

The Novato series consists of very deep, very poorly drained soils in tidal marshes along the margins of San Francisco Bay. These soils formed in alluvium derived from various kinds of rock. Slope ranges from 0 to 1 percent.

Soils of the Novato series are fine, mixed, nonacid, isomesic Typic Hydraquents.

Typical pedon of Novato clay, 0 to 1 percent slopes, near Foster City; 330 feet north on Beach Park

Boulevard from its intersection with Foster City Boulevard and 150 feet east of Beach Park Boulevard; 75 feet east of asphalt pavement on top of dike (not sectionalized); Redwood Point 7.5' Quadrangle:

A1g—0 to 6 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; common medium distinct dark yellowish brown (10YR 3/4, moist) mottles; massive; extremely hard, firm, sticky and plastic; many very fine roots; many very fine tubular pores and few fine and medium pores; moderately alkaline; clear irregular boundary.

A2g—6 to 16 inches; light olive gray (5Y 6/2) clay, variegated olive gray (5Y 4/2) and very dark gray (N 3/0) moist; common medium faint dark yellowish brown (10YR 3/4, moist) mottles; massive; extremely hard, firm, sticky and plastic; few very fine roots; moderately alkaline; diffuse smooth boundary.

C1g—16 to 30 inches; gray (5Y 5/1) clay, variegated dark gray (5Y 4/1) and dark greenish gray (5BG 4/1) moist; common medium distinct pale yellow (5Y 8/4, moist) jarosite mottles; massive; extremely hard, firm, sticky and plastic; moderately alkaline; diffuse smooth boundary.

C2g—30 to 45 inches; dark gray (10YR 4/1) clay, very dark gray (N 3/0) moist; massive; extremely hard, firm, sticky and plastic; moderately alkaline; diffuse smooth boundary.

C3g—45 to 60 inches; gray (5Y 6/1) clay, very dark gray (N 3/0) moist; massive; extremely hard, firm, sticky and plastic; moderately alkaline.

These soils are saturated with water year round. The N value is more than 1. Sulfidic materia is below a depth of 20 inches. The content of organic matter decreases irregularly with increasing depth. The profile is strongly alkaline or moderately alkaline throughout and is noncalcareous.

The Ag horizon has color of 5Y 5/1, 5/2, or 6/2 or of 2.5Y 5/2 or 6/2. Moist color is 5Y 4/1 or 4/2, N 3/0, or 2.5Y 3/2 or 4/2. The horizon has common medium distinct or faint mottles that have color of 10YR 3/4.

The Cg horizon has color of 10YR 4/1, of 5Y 4/2, 5/1, 6/1, or 6/2, or of N 5/0 or 6/0. Moist color is 5Y 4/1 or 4/2, 2.5Y 4/1 or 4/2, N 2/0 or 3/0, or 5BG 4/1. Common medium distinct jarosite mottles that have color of 5Y 8/4 are in most pedons. Texture is silty clay, clay, or silty clay loam.

Obispo Series

The Obispo series consists of shallow, well dra ned soils on gently rolling to hilly uplands. These soils formed in material weathered from hard, serpentinitic rock. Slope ranges from 5 to 30 percent.

Soils of the Obispo series are clayey, serpentinitic, thermic Lithic Haploxerolls.

Typical pedon of Obispo clay, 5 to 15 percent slopes; 3,200 feet south on Skyline Boulevard from its intersection with Hayne Road and 10 feet west of Skyline Boulevard (not sectionalized); San Mateo 7.5' Quadrangle:

A1—0 to 4 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong fine granular structure and strong coarse subangular blocky structure; extremely hard, firm, sticky and plastic; many very fine roots; few very fine and fine tubular and interstitial pores; moderately alkaline; clear irregular boundary.

A2—4 to 12 inches; very dark gray (10YR 3/1) clay, very dark brown (10YR 2/2) moist; strong coarse and very coarse subangular blocky structure; extremely hard, firm, sticky and plastic; common very fine roots; few very fine and fine tubular and interstitial pores; moderately alkaline; abrupt irregular boundary.

R—12 inches; hard, serpentinitic rock.

Unweathered serpentine is at a depth of 10 to 20 inches. The profile averages 0 to 10 percent gravel. Unless the soils are irrigated, cracks 0.5 inch to 3.0 inches wide extend to bedrock and remain open in summer until it rains.

The A1 horizon has color of 10YR 3/1 or 4/1. Moist color is 10YR 2/1, 2/2, or 3/1.

The A2 horizon has color of 10YR 3/1 or 4/1. Moist color is 10YR 2/2 or 3/1. Texture is clay or clay loam.

Orthents

Orthents are very shallow to very deep, very poorly drained to excessively drained soils on uplands, including hills and ridgetops; alluvial fans; coastal terraces; flood plains; and tidal flats. These soils formed in alluvium derived from various kinds of rock; sandy coastal deposits; hard and soft sandstone, shale, siltstone, serpentine, and volcanic rock; and various manmade fill material. Slope is 0 to 75 percent.

Reference pedon of Orthents, cut and fill, 15 to 75 percent slopes, at Oceana High School in Pacifica; 750 feet east and 4,200 feet north of the intersection of Highway 1 and Sharp Park Road (not sectionalized); San Francisco South 7.5' Quadrangle:

A—0 to 4 inches; dark yellowish brown (10YR 4/4)

gravelly loam, dark brown (10YR 3/3) moist; strong fine, medium, and coarse subangular blocky structure; hard, firm, sticky and plastic; many very fine roots; slightly acid; clear irregular boundary.

Cr—4 inches; light olive brown (2.5Y 5/4), soft, fractured, slightly metamorphosed sandstone, olive brown (2.5Y 4/4) moist.

These soils are extremely variable. They consist of areas of undisturbed loamy material on coastal terraces; areas that have been mechanically altered for residential and other urban uses and have cuts that have slopes of 3:1 to 1.5:1 and fills that are 0 to 75 feet deep or more; smoothed areas on alluvial fans and plains; reclaimed areas near San Francisco Bay; and areas on the margins of the bay that consist of earthy material, rock fragments, plant matter, and manmade debris.

Reyes Series

The Reyes series consists of very deep, somewhat poorly drained soils that formed in alluvium derived from various kinds of rock. These soils are on reclaimed tidelands along the margins of San Francisco Bay. Slope is 0 to 1 percent.

Soils of the Reyes series are fine, mixed, acid, thermic Sulfic Fluvaquents.

Typical pedon of Reyes clay, 0 to 1 percent slopes; 670 feet north of gate on dirt road at the eastern end of Whipple Avenue, in Redwood City, and 110 feet west of dirt road (not sectionalized); Redwood Point 7.5' Quadrangle:

Ap—0 to 9 inches; gray (10YR 6/1) clay, very dark grayish brown (10YR 3/2) moist; common fine distinct strong brown (7.5YR 5/6, moist) mottles; moderate fine, medium, and coarse subangular blocky structure; extremely hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular and interstitial pores; strongly acid; clear irregular boundary.

A—9 to 22 inches; gray (5YR 5/1) clay, dark gray (10YR 4/1) moist; many fine distinct dark yellowish brown (10YR 4/6) mottles, yellow (10YR 7/6) moist; moderate fine, medium, and coarse subangular blocky structure; extremely hard, firm, sticky and plastic; common very fine roots; common very fine and fine tubular pores and few medium and coarse interstitial pores; very strongly acid; clear smooth boundary.

Bg—22 to 30 inches; gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; common fine distinct pale yellow (5Y 8/3) jarosite mottles, very pale brown (10YR 7/4) moist; massive; extremely hard, firm, sticky and plastic; few very fine tubular pores and common medium and coarse interstitial pores; very strongly acid; clear smooth boundary.

C2g—30 to 60 inches; gray (5Y 6/1) clay, dark greenish gray (5GY 4/1) moist; few jarosite mottles; massive; extremely hard, firm, sticky and plastic; moderately alkaline.

The content of organic matter in the profile decreases irregularly with increasing depth. These soils are artificially drained. The N value ranges from 0.3 to 0.7. Jarosite mottles are at a depth of 20 to 40 inches.

The A horizon has color of 10YR 5/1, 5/2, 6/1, or 6/2 or of 2.5Y 5/2 or 6/2. Moist color is 10YR 3/2, 3/3, 4/1, or 4/2 or 2.5Y 3/2 or 4/2. The horizon has few to many fine or medium distinct mottles that have color of 5YR 4/3, 4/4, or 4/6, of 7.5YR 4/6 or 5/6, or of 10YR 4/6. Reaction is strongly acid or very strongly acid.

The B horizon has color of 10YR or 5Y 5/1, 5/2, 6/1, or 6/2 or of N 5/0 or 6/0. Moist color is 10YR or 5Y 4/1 or 5/1 or N 4/0 or 5/0. The horizon has distinct or prominent mottles that have hue of 5Y, 2.5Y, 10YR, 7.5YR, or 5YR. Moist value of the mottles commonly is 4, but it is 5 in areas where hue is 5Y or 2.5Y. The lower part of the B horizon has many or common jarosite mottles that have color of 2.5Y 7/6, 8/6, or 8/8 or of 5Y 7/6, 7/8, 8/3, 8/6, or 8/8.

The C horizon has color of 5Y 6/1 or 6/2. Moist color is 5Y 4/1 or 5/1, N 4/0 or 5/0, or 5GY 4/1. The horizon has few or common fine or medium distinct or prominent jarosite mottles. Reaction is very strongly acid to medium acid in drained areas and is moderately alkaline in saturated areas. Texture is clay or silty clay.

Scarper Series

The Scarper series consists of moderately deep, well drained soils on uplands. These soils formed in material weathered from quartz-diorite. Slope ranges from 30 to 75 percent.

Soils of the Scarper series are coarse-loamy, mixed, isomesic Typic Haplustolls.

Typical pedon of Scarper gravelly coarse sandy loam, in an area of Scarper-Miramar complex, 30 to 75 percent slopes; 7,700 feet east and 1,500 feet north of Point Montara Lighthouse (not sectionalized); Montara Mountain 7.5' Quadrangle:

A1—0 to 5 inches; dark grayish brown (10YR 4/2)

gravelly coarse sandy loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many fine and medium interstitial pores; 25 percent pebbles 2 to 75 millimeters in diameter; medium acid; clear smooth boundary.

A2—5 to 16 inches; very dark grayish brown (10YR 3/2) gravelly coarse sandy loam, very dark gray (10YR 3/1) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many fine and medium interstitial pores; 15 percent pebbles 2 to 75 millimeters in diameter; slightly acid; clear irregular boundary.

C—16 to 25 inches; brown (7.5YR 4/2) gravelly coarse sandy loam, dark brown (7.5YR 3/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; many fine and medium interstitial pores; 15 percent pebbles 2 to 75 millimeters in diameter; slightly acid; clear irregular boundary.

Cr—25 inches; quartz-diorite that slakes easily in water.

Bedrock is at a depth of 20 to 40 inches. The difference between the mean summer soil temperature and the mean winter soil temperature is less than 9 degrees F. Total sand content averages 60 to 70 percent and clay content averages less than 18 percent throughout the profile. The profile averages 15 to 25 percent gravel.

The A horizon has color of 10YR 3/2, 4/1, 4/2, 5/1, 5/2, or 5/3. Moist color is 10YR 2/2, 3/1, 3/2, or 4/3.

The C horizon has color of 7.5YR or 10YR 4/2, 4/3, 5/2, or 5/3. Moist color is 7.5YR 3/2 or 10YR 3/2 or 4/3.

Sirdrak Series

The Sirdrak series consists of very deep, somewhat excessively drained soils on coastal dunes. These soils formed in eolian sand. Slope ranges from 5 to 50 percent.

Soils of the Sirdrak series are sandy, mixed, isomesic Ustic Dystropepts.

Typical pedon of Sirdrak sand, 5 to 50 percent slopes; 1,050 feet west of the intersection of Skyline and Alemany Boulevards, at Thornton State Beach (not sectionalized); San Francisco South 7.5' Quadrangle:

A1—0 to 9 inches; dark brown (10YR 4/3) sand, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; loose, nonsticky and nonplastic; many very fine roots; many very fine tubular and interstitial pores; slightly acid; clear irregular boundary.

A2—9 to 17 inches; dark yellowish brown (10YR 4/4) sand, very dark grayish brown (10YR 3/2) moist; massive; loose, nonsticky and nonplastic; few very fine roots; many very fine interstitial pores and few very fine tubular pores; slightly acid; abrupt smooth boundary.

C1—17 to 28 inches; yellowish brown (10YR 5/4) sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine interstitial pores and few very fine tubular pores; slightly acid; clear wavy boundary.

C2—28 to 60 inches; yellowish brown (10YR 5/4) sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; many very fine interstitial pores and few very fine tubular pores; slightly acid.

Sand content is 90 to 98 percent throughout the profile. Reaction is strongly acid to slightly acid throughout. The difference between the mean summer soil temperature and the mean winter soil temperature is less than 9 degrees F.

The A horizon has color of 10YR 4/2, 4/3, or 4/4. Moist color is 10YR 3/2 or 2/2.

The C horizon has color of 10YR 4/4, 5/4, 6/3, or 6/4 or of 2.5Y 4/2. Moist color is 10YR 4/4 or 2.5Y 4/2.

Typic Argiustolls

Typic Argiustolls consist of deep, well drained soils on coastal terraces. These soils formed in alluvium derived from various kinds of rock. Slope ranges from 5 to 15 percent.

Reference pedon of Typic Argiustolls, in an area of Typic Argiustolls, loamy-Urban land association, 5 to 15 percent slopes; 1,250 feet north-northeast of Farallone School, in Montara, and 1,900 feet east of California Highway 1 (not sectionalized); Montara 7.5' Quadrangle:

A1—0 to 6 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and plastic; common very fine and fine roots; many very fine and fine interstitial and tubular pores; slightly acid; gradual smooth boundary.

A2—6 to 11 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure; hard, friable, sticky and plastic; common very fine and fine roots; many very fine and fine tubular and interstitial pores; medium acid; clear irregular boundary.

Bt1—11 to 25 inches; yellowish brown (10YR 5/4) clay, variegated strong brown (7.5YR 5/8) and very pale brown (10YR 7/4) moist; common fine distinct brownish yellow (10YR 6/6) mottles; massive; extremely hard, firm, sticky and plastic; common fine roots; common very fine and fine tubular and interstitial pores; few thin clay films in pores and as bridges and common thick clay films on fracture planes; medium acid; gradual wavy boundary.

Bt2—25 to 31 inches; brownish yellow (10YR 6/6) sandy clay loam, variegated strong brown (7.5YR 5/8) and light yellowish brown (10YR 6/4) moist; few fine distinct very pale brown (10YR 7/4) mottles; massive; very hard, firm, sticky and plastic; few fine roots; common very fine and fine tubular and interstitial pores; few thin clay films on fracture planes and in pores; medium acid; gradual wavy boundary.

Bt3—31 to 37 inches; variegated yellowish brown (10YR 5/6) and light yellowish brown (10YR 6/4) sandy clay loam, strong brown (7.5YR 5/6) and very pale brown (10YR 7/3) moist; massive; very hard, firm, sticky and plastic; few very fine roots; common very fine and fine tubular and interstitial pores; few thin clay films on fracture planes and in pores; medium acid; gradual wavy boundary.

BC—37 to 60 inches; variegated yellowish brown (10YR 5/6) and light yellowish brown (10YR 6/4) sandy clay loam, strong brown (7.5YR 5/6 and 5/8) and pale brown (10YR 6/3) moist; massive; hard, firm, slightly sticky and slightly plastic; common very fine tubular and interstitial pores; medium acid.

The solum is 40 to more than 60 inches thick. Reaction is neutral to medium acid.

The A1 horizon has color of 10YR 3/1, 4/1, 4/2, or 5/2. It is loam, sandy loam, sandy clay loam, or clay loam.

The Bt horizon has color of 7.5YR 5/6 or 5/8 or of 10YR 5/4, 6/4, 6/6, or 7/4. It is sandy clay loam, clay loam, or clay.

Zeni Series

The Zeni series consists of moderately deep, well drained soils on uplands. These soils formed in material weathered from sandstone. Slope ranges from 30 to 75 percent.

Soils of the Zeni series are fine-loamy, mixed, isomesic Ultic Haplustalfs.

Typical pedon of Zeni gravelly loam, in an area of Zeni-Zeni Variant gravelly loams, 30 to 75 percent slopes, in the San Francisco Water District; 4,500 feet east on service road to San Andreas Lake from the intersection of Portola Road and Pilarcitos Road and 100 feet southwest of service road (not sectionalized); Montara Mountain 7.5' Quadrangle:

O—0.5 inch to 0; leaves and twigs.

A1—0 to 3 inches; pale brown (10YR 6/3) gravelly loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; strong very fine and fine roots and few medium roots; many very fine and fine tubular and interstitial pores and few coarse tubular pores; 20 percent pebbles 2 to 5 millimeters in diameter; medium acid; clear wavy boundary.

A2—3 to 9 inches; pale brown (10YR 6/3) gravelly loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine tubular and interstitial pores; 20 percent pebbles 2 to 5 millimeters in diameter; strongly acid; clear irregular boundary.

Bt1—9 to 18 inches; reddish yellow (7.5YR 7/6) gravelly clay loam, strong brown (7.5YR 5/6) moist; moderate fine and coarse subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine and medium roots; many very fine and fine tubular and interstitial pores; 15 percent pebbles 2 to 5 millimeters in diameter; strongly acid; diffuse irregular boundary.

Bt2—18 to 26 inches; very pale brown (10YR 7/4) gravelly clay loam, variegated strong brown (7.5YR 5/6) and yellowish red (5YR 4/6) moist; massive; very hard, firm, slightly sticky and slightly plastic; many very fine and fine tubular and interstitial pores; 20 percent pebbles 2 to 5 millimeters in diameter; many moderately thick clay films in pores and as bridges between mineral grains; strongly acid; diffuse irregular boundary.

Cr—26 inches; sandstone.

Bedrock is at a depth of 20 to 40 inches. Base saturation is 50 to 75 percent throughout the profile.

The difference between the mean summer soil temperature and the mean winter soil temperature is less than 9 degrees F. The profile averages from 15 to 35 percent gravel.

The A horizon has color of 10YR 6/2, 6/3, 7/1, 7/2, or 7/3. Moist color is 10YR 4/4 or 5/3 or 7.5YR 4/4. Reaction is medium acid or strongly acid.

The Bt horizon has color of 7.5YR 7/6 or of 10YR 7/3, 7/4, 7/5, 8/3, or 8/4. Moist color is 5YR 4/6, 7.5YR 5/4 or 5/6, or 10YR 5/4, 5/6, or 6/4.

The Zeni soils in this survey area are taxadjuncts to the Zeni series because they receive less precipitation and dry out in some parts earlier in the year than is defined for the series. These differences, however, do not significantly affect the use and management of the soils.

Zeni Variant

The Zeni Variant consists of moderately deep, well drained soils on uplands. These soils formed in material weathered from hard metasedimentary rock. Slope ranges from 30 to 75 percent.

Soils of the Zeni Variant are loamy-skeletal, mixed, isomesic Typic Argiustolls.

Typical pedon of Zeni Variant gravelly loam, in an area of Zeni-Zeni Variant gravelly loams, 30 to 75 percent slopes, in the San Francisco Water District; 3,000 feet east on service road to San Andreas Lake from the intersection of Portola Road and Pilarcitos Road, 500 feet east on dirt road on spur ridge, and 50 feet north of road (not sectionalized); Montara Mountain 7.5' Quadrangle:

O—1 inch to 0; decomposed and undecomposed litter from hardwoods and brush.

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) gravelly loam, very dark brown (10YR 2/2) moist; moderate very fine and fine granular structure and moderate fine and medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; few coarse roots and many fine and medium roots; common coarse and many very fine and fine tubular and interstitial pores; 15 percent pebbles 2 to 40 millimeters in diameter; medium acid; clear smooth boundary.

A2—4 to 13 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few coarse roots and many fine and medium roots; many very fine and fine tubular and interstitial pores and few coarse interstitial pores; 20 percent pebbles 2 to 20 millimeters in diameter; medium acid; clear irregular boundary.

Bt1—13 to 21 inches; pale brown (10YR 6/3) very gravelly clay loam, very dark grayish brown (10YR 3/2) mo st; weak fine and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium roots; many very fine and fine tubular and interstitial pores; few thin clay films on ped faces and in pores; 35 percent pebbles 2 to 75 millimeters in diameter and 10 percent stones 3 to 5 inches in diameter; strongly acid; diffuse irregular boundary.

Bt2—21 to 31 inches; very pale brown (10YR 7/3) very gravelly clay loam, brown (10YR 4/3) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine and fine tubular and interstitial pores; few thin clay films bridging sand grains and in pores; 35 percent pebbles 2 to 75 millimeters in diameter and 10 percent stones 3 to 5 inches in diameter; strongly acid; diffuse irregular boundary.

Bt3—31 to 39 inches; light yellowish brown (10YR 6/4) gravelly clay loam, brown (10YR 4/3) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine and fine tubular and interstitial pores; few thin clay films bridging sand grains and in pores; 25 percent pebbles 2 to 75 millimeters in diameter and 10 percent stones 3 to 5 inches in diameter; strongly acid; clear irregular boundary.

R—39 inches; hard, fractured metasedimentary rock.

Bedrock is at a depth of 20 to 40 inches. Base saturation is more than 75 percent throughout the profile. The difference between the mean summer soil temperature and the mean winter soil temperature is less than 9 degrees F.

The A horizon has color of 10YR 3/2, 4/1, 4/2, or 5/2. Moist color is 10YR 2/2, 3/1, or 3/2. Gravel content is 15 to 25 percent. Reaction is slightly acid or medium acid.

The Bt horizon has color of 10YR 6/1, 6/2, 6/3, 6/4, 7/2, or 7/3. Moist color is 10YR 3/2, 3/3, 4/3, 4/4, 5/2, or 5/3. The content of coarse fragments ranges from 35 to 45 percent. Reaction is strongly acid or medium acid.

Formation of the Soils

Soil is a natural body on the surface of the earth in which plants grow. It is a mixture of rocks, minerals, organic matter, water, and air in varying proportions. The interaction of five soil-forming factors—living organisms, climate, topography, parent material, and time—determines the characteristics of a soil. Each of these factors affects the formation of every soil, and each factor modifies the effects of the other factors.

Climate and living organisms are the active forces of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into soil. Topography modifies the effects of climate and vegetation, mainly by its influence on runoff and soil temperature. The nature of the parent material also affects the kind of soil that is formed. Time is needed for parent material to change into soil. Generally, a long time is needed for distinct soil horizons to form. The interaction of these soil-forming factors is more complex for some soils than for others.

In the following paragraphs, the five factors of soil formation are discussed in relation to their effects on the soils in this survey area.

Living Organisms

Plants, animals, insects, bacteria, and fungi affect soil formation by contributing organic matter and nitrogen to the soils, causing gains or losses in plant nutrients, and changing the structure and porosity of the soils. Plants generally have a greater effect on soil formation than do other living organisms.

Grass is the dominant vegetation along the coastal terraces. Douglas fir, coastal redwood, hardwoods, brush, and shrubs are dominant on the east-facing slopes west of the San Andreas Fault. East of the fault, annual grasses, forbs, and hardwoods are dominant. Pickleweed, saltgrass, and cordgrass are dominant on the salt marshes that border San Francisco Bay. In general, the differences in vegetation are associated with the differences in parent material.

The north- and east-facing slopes are shaded from sunlight. This shading reduces the rate of evaporation, which increases the amount of water available to plants, and it increases the length of time during which biological activity can take place. Soils on these slopes support a dense canopy of hardwoods, conifers, brush, and shrubs. These plants provide shade and cover, which reduces runoff and erosion. A mat of undecomposed and partially decomposed needles, leaves, and twigs has accumulated on the surface in some areas. Because of the acidity of this mat, it contributes to an increased rate of weathering. Roots of plants on these soils extend into the fractures in the bedrock and cause physical and chemical changes. The roots also help to prevent erosion and facilitate the accumulation of soil material.

The soils in the survey area have been disturbed by mining, clearing or burning of vegetation, harvesting of timber, livestock grazing, cultivation, and urbanization. Burning depletes the organic matter content of the soils and changes the plant community. The shaping and grading involved in urban development change soil horizons.

Climate

Climate, which is mainly the distribution of heat and moisture, influences the physical, chemical, and biological processes in soils. Water dissolves minerals, allows biological activity to take place, and transports minerals and organic residue through the soil. Temperature determines the kinds of physical, chemical, and biological changes that take place in the soil and the speed at which the changes occur.

There are three different climatic regions in the survey area. They are the coastal areas, the higher areas of the Santa Cruz Mountains, and the lower areas adjacent to San Francisco Bay. Generally, the rates of weathering and soil formation are most rapid in the cool, moist coastal region. Soils form at a moderate rate in the warmer, drier interior valleys, and they form at a slow rate in the colder areas at higher elevations.

Although the average annual air temperature in the survey area only ranges from 54 to 58 degrees F, there is a great difference between the maximum and minimum temperatures from one climatic region to another. The average annual rainfall ranges from 15 to 45 inches. Rainfall throughout the survey area is sufficient to leach the soils of soluble bases, thus lowering reaction. The soils commonly are slightly acid to strong y acid. On the higher ridges, some of the precipitation falls as snow in winter in some years.

In areas along the coast, fog occurs in summer, humidity is higher, and the transpiration rate and temperature are lower. This mild climate results in soils that have a thick, dark surface layer.

The soil-forming processes work in cycles. Weathering is relatively rapid in spring and early in summer, but it is slow in fall. Little weathering occurs in winter. The warm temperatures in spring are favorable for rapid soil formation. Chemical reaction occurs rapidly, and water from the spring rains moves through the soil and removes dissolved or suspended material. The remains of plants decompose rapidly, and the organic acids that are produced hasten the formation of clay.

Topography

Topography is largely determined by the underlying geologic formations and the geologic history of a region. Topography determines elevation, slope, and aspect. It influences soil formation through its effects on climate, drainage, plant cover, and soil temperature.

Steepness, shape, and length of slopes affect the rate of runoff and erosion and the amount of moisture available for soil development. Geologic erosion is active on the steeper slopes in the uplands. Soil material is removed nearly as fast as it is formed, and a more rapid rate of runoff limits the leaching of the soils and the weathering of the parent material. The soils on uplands generally are shallow to bedrock.

Elevation results in pronounced variations in rainfall over short distances, and it influences soil temperature. Elevation in this survey area ranges from sea level to about 2,000 feet above sea level.

Aspect has an important effect on microclimate. It determines the amount of heat absorbed from the sun. Soils on north- and east-facing slopes are cooler and stay moist longer than those on south- and west-facing slopes.

In the less sloping alluvial areas, relatively large amounts of water pass through the soils and much leaching and translocation of clay occurs.

Parent Material

Parent material is the weathered rock or unconsolidated material in which soils develop. It largely determines the chemical and mineralogical composition of soils.

The San Andreas Fault divides the survey area. West of the fault zone, Butano Sandstone of middle and lower Miocene age extends from Portola Valley to south of California Highway 92. North of Highway 92, parent material of the Franciscan Formation is dominant *(4)*. It consists of sandstone, graywacke, shale, chert, and greenstone. A significant amount of the Franciscan Formation is melange, which is masses of rock that has been sheared and crushed as a result of movement of the North American and Pacific plates *(6)*. Subsequent uplifts have exposed the rock west of the San Andreas Fault zone, on Montara Mountain. These exposures consist of granitic rock of Upper Cretaceous age and sandstone, shale, and conglomerate of Paleocene age.

Along the eastern edge of the San Andreas Fault zone, extending south from San Andreas Lake, the Franciscan Formation is dominant. Ultrabasic rock forms intrusions in the Franciscan Formation, and it commonly has been altered to serpentinite. Between the San Bruno Fault and the San Andreas Fault, at the northern end of San Mateo County, are the Colma and Merced Formations of Pleistocene age. These formations consist of loose to friable sandstone, siltstone, and sand. Dune sand underlies more than half of San Francisco County. It was deposited in areas more than 600 feet above sea level by prevailing westerly winds from the Ocean Beach area.

The youngest geologic material in the survey area, which is of Holocene age, is recent alluvial deposits of sand, silt, and clay along the western edge of San Francisco Bay. This alluvium has mixed lithology because it was deposited from different geologic formations of the uplands. A large part of this area is made up of soils that have been disturbed for urban development.

Time

The length of time the soil-forming factors have been interacting largely determines the specific properties of soils. The soils in this survey area range from young to old. The young soils exhibit little if any alteration of parent material or formation of distinct horizons. The old soils have highly altered parent material and well defined horizons.

The Sirdrak and Fagan soils are examples of those

that have different characteristics mainly because of the differences in the length of time the soils have been in place. The Sirdrak soils are young; they have an accumulation of organic matter in the A horizon but do not have well developed horizons. The Fagan soils are at a slightly higher elevation, and they have been stable long enough for an argillic horizon to develop. The B horizon in the Fagan soils contains more clay than the A horizon, carbonates have been leached from the parent material, and reaction is slightly acid or medium acid.

The oldest soils may not form in the oldest geologic formations. Where slope is very steep or steep, geologic erosion and soil creep may equal the rates of soil formation and weathering. The soils in areas where this occurs are considered young.

References

(1) American Association of State Highway and Transportation Officials. 1982. Standard specifications for highway materials and methods of sampling and testing. Ed. 13, 2 vols., illus.

(2) American Society for Testing and Materials. 1985. Standard test method for classification of soils for engineering purposes. ASTM Stand. D 2487.

(3) Austin, Morris E. 1965. Land resource regions and major land resource areas of the United States. U S. Dep. Agric. Handb. 296, 82 pp., map.

(4) Baily, Edgar H., William P. Irwin, and David L. Jones. 1964. Franciscan and related rocks, and their significance in the geology of western California. CA Div. Mines and Geol. Bull. 183, 171 pp., map.

(5) California Department of Fish and Game. 1980. At the crossroads, a report on the status of California's endangered and rare fish and wildlife. 147 pp., illus.

(6) Hsu, K.J. 1968. Principles of melanges and their bearing on the Franciscan-Knoxville paradox. Geol. Soc. Amer. Bull., vol. 79, 8: 1063-1074.

(7) United States Department of Agriculture. 1917. Reconnaissance soil survey of the San Francisco Bay Region, California. Bureau of Soils. 112 pp., map.

(8) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. (Supplements replacing pp. 173-188 issued May 1962)

(9) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 2.5
Low	2.5 to 5.0
Moderate	5.0 to 7.5
High	7.5 to 10.0
Very high	more than 10.0

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy. The leafy crown of trees or shrubs.

Canyon. A long, deep, narrow, very steep sided valley with high, precipitous walls in an area of high local relief.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural

class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 cent meters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscel aneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conglomerate. A coarse grained, clastic rock composed of rounded to subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer material. Conglomerate is the consolidated equivalent of gravel.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and low water-holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

Well drained.—These soils have intermediate water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless artificial drainage is provided. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless artificial drainage is provided. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. They are wet enough to prevent the growth of important crops (except rice) unless artificially drained.

Drainage, surface. Runoff, or surface flow of water, from an area.

Duff. A term used to identify a generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Effective rooting depth (potential rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and produced by erosion or faulting. Synonym: scarp.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salt (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess sulfur (in tables). Excessive amount of sulfur in the soil. The sulfur causes extreme acidity if the soil is drained, and the growth of most plants is restricted.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is more than 15 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard rock. Rock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well-defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the number 2 precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the

acreage is artificially drained and part is undrained.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides and considerable bare-rock surface. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

N value. The relationship between the percentage of water in a soil under field conditions and the percentages of inorganic clay and humus. The N value is helpful in predicting whether a soil is suitable for grazing by livestock or can support other loads and in predicting the degree of subsidence that would occur after a soil was drained.

Open space. A relatively undeveloped green or wooded area provided mainly within an urban area to minimize feelings of congested living.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting (in tables). Pits caused by melting around ice. They form on the soil after plant cover is removed.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through

the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the ower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site class. A grouping of site indexes into 5 to 7 production capability levels. Each level can be represented by a site curve.

Site curve (100-year). A set of related curves on a graph that show the average height of dominant and codominant trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the following slope classes are recognized (terms used for complex slopes, if different from those used for simple slopes, are given in parentheses):

Nearly level	0 to 2 percent
Gently sloping (undulating)	2 to 5 percent
Moderately sloping (gently rolling)	5 to 9 percent
Strongly sloping (rolling)	9 to 15 percent
Moderately steep (hilly)	15 to 30 percent
Steep	30 to 50 percent
Very steep	50 percent and higher

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soft rock. Rock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0 002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 6 to 15 inches (15 to 38 centimeters) in length if flat.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Underlying material. The part of the soil below the A or Ac horizon that is relatively unaffected by the processes of soil formation.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

Month	Temperature						Precipitation			
				2 years in 10 will have--				2 years in 10 will have--		
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more
	°F	°F	°F	°F	°F	Units	In	In	In	
Recorded in the period 1948-88 at Redwood City, California										
January----	58.0	39.1	48.5	70	26	267	4.49	1.80	6.75	6
February---	62.3	41.8	52.1	75	30	342	3.38	1.00	5.31	6
March------	65.2	43.0	54.1	82	32	449	2.86	0.83	4.51	5
April------	70.4	44.6	57.5	88	36	524	1.35	0.32	2.23	3
May--------	75.4	48.1	61.7	96	39	672	0.34	0.09	0.74	1
June-------	80.4	52.0	66.2	101	42	785	0.07	0.03	0.21	0
July-------	82.7	53.9	68.3	102	45	894	0.03	0.03	0.16	0
August-----	82.4	53.9	68.2	99	46	872	0.06	0.02	0.28	0
September--	81.5	52.7	67.1	100	43	808	0.25	0.05	0.68	0
October----	74.8	48.6	61.7	93	38	673	0.96	0.16	1.85	1
November---	65.6	43.6	54.6	81	31	448	2.72	0.72	4.57	4
December---	58.6	39.9	49.2	71	27	295	3.73	1.23	5.78	6
Yearly:										
Average--	71.4	46.8	59.1	---	---	---	---	---	---	---
Extreme--	110.0	16.0	---	104	25	---	---	---	---	---
Total----	---	---	---	---	---	7,029	20.26	8.75	28.22	32
Recorded in the period 1948-88 at San Francisco, California										
January----	56.0	45.8	50.9	69	37	339	4.37	1.95	6.44	7
February---	59.7	48.4	54.0	73	40	396	3.07	1.00	4.77	6
March------	60.3	48.7	54.5	78	41	449	3.05	1.06	4.69	6
April------	61.9	49.3	55.6	83	43	468	1.39	0.27	2.31	3
May--------	63.1	50.8	56.9	88	46	525	0.33	0.07	0.65	1
June-------	65.0	52.8	58.9	90	48	565	0.13	0.03	0.37	0
July-------	64.8	53.3	59.0	86	49	590	0.03	0.01	0.12	0
August-----	65.7	54.4	60.1	85	50	622	0.07	0.01	0.20	0
September--	69.4	55.8	62.6	93	50	678	0.27	0.06	0.66	0
October----	68.7	54.7	61.7	90	48	672	1.14	0.15	2.03	1
November---	63.2	51.4	57.3	79	43	518	2.88	0.75	4.70	5
December---	56.8	47.1	52.0	69	38	371	3.62	1.52	5.39	6
Yearly:										
Average--	62.9	51.0	57.0	---	---	---	---	---	---	---
Extreme--	102.0	30.0	---	97	36	---	---	---	---	---
Total----	---	---	---	---	---	6,194	20.35	10.21	27.73	35

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the range vegetation in the area (40 degrees F).

TABLE 2.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

(Entries in the column "Total--Extent" are percentages of the total land area only)

Map symbol	Soil name	San Mateo County	San Francisco County	Total--	
				Area	Extent
		Acres	Acres	Acres	Pct
101	Accelerator-Fagan association, 5 to 15 percent slopes	1,495	0	1,495	1.0
102	Accelerator-Fagan-Urban land complex, 5 to 15 percent slopes	2,325	0	2,325	1.5
103	Alambique sandy loam, 15 to 75 percent slopes	1,370	0	1,370	0.9
104	Alambique-McGarvey complex, 30 to 75 percent slopes	13,550	0	13,550	8.9
105	Barnabe-Candlestick complex, 30 to 75 percent slopes	5,850	345	6,195	4.1
106	Barnabe-Rock outcrop complex, 15 to 75 percent slopes	500	0	500	0.3
107	Botella loam, 0 to 5 percent slopes	665	0	665	0.4
108	Botella-Urban land complex, 0 to 5 percent slopes	4,175	0	4,175	2.8
109	Candlestick-Barnabe complex, 30 to 50 percent slopes	620	0	620	0.4
110	Candlestick-Kron-Buriburi complex, 30 to 75 percent slopes	4,425	670	5,095	3.4
111	Candlestick Variant loam, 2 to 15 percent slopes	1,100	0	1,100	0.7
112	Candlestick Variant loam, 15 to 30 percent slopes	200	0	200	0.1
113	Fagan loam, 15 to 50 percent slopes	2,760	0	2,760	1.8
114	Francisquito-Urban land complex, 5 to 15 percent slopes	2,010	0	2,010	1.3
115	Los Gatos loam, 30 to 75 percent slopes	4,175	0	4,175	2.8
116	Maymen gravelly loam, 30 to 50 percent slopes	1,490	0	1,490	1.0
117	Novato clay, 0 to 1 percent slopes	1,600	0	1,600	1.1
118	Novato clay, 0 to 1 percent slopes, ponded	3,225	0	3,225	2.1
119	Obispo clay, 5 to 15 percent slopes	600	0	600	0.4
120	Obispo clay, 15 to 30 percent slopes	600	0	600	0.4
121	Orthents, cut and fill, 0 to 15 percent slopes	3,125	1,440	4,565	3.0
122	Orthents, cut and fill, 15 to 75 percent slopes	1,235	30	1,265	0.8
123	Orthents, cut and fill-Urban land complex, 0 to 5 percent slopes	1,875	0	1,875	1.2
124	Orthents, cut and fill-Urban land complex, 5 to 75 percent slopes	8,275	1,285	9,560	6.3
125	Pits and Dumps	520	60	580	0.4
126	Reyes clay, 0 to 1 percent slopes	3,325	0	3,325	2.2
127	Rock outcrop-Orthents complex, 30 to 75 percent slopes	705	295	1,000	1.5
128	Scarper-Miramar complex, 30 to 75 percent slopes	2,360	0	2,360	1.6
129	Sirdrak sand, 5 to 50 percent slopes	250	2,090	2,340	1.6
130	Typic Argiustolls, loamy-Urban land association, 5 to 15 percent slopes	1,415	325	1,740	1.2
131	Urban land	7,845	4,965	12,810	8.3
132	Urban land-Orthents, cut and fill complex, 0 to 5 percent slopes	8,490	1,215	9,705	6.4
133	Urban land-Orthents, cut and fill complex, 5 to 75 percent slopes	8,340	4,350	12,690	8.4
134	Urban land-Orthents, reclaimed complex, 0 to 2 percent slopes	12,805	5,055	17,860	11.8
135	Urban land-Orthents, smoothed complex, 5 to 50 percent slopes	6,415	695	7,110	4.7
136	Urban land-Sirdrak complex, 2 to 50 percent slopes	675	5,980	6,655	4.4
137	Zeni-Zeni Variant gravelly loams, 30 to 75 percent slopes	1,270	0	1,270	0.8
	Total land area	121,660	28,800	150,460	100.0
	Water	174,425	33,850	208,275	
	Total area	296,085	62,650	358,735	

TABLE 3.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
101*:					
Accelerator	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Fagan	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.	Moderate: slope.
102*:					
Accelerator	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Fagan	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.	Moderate: slope.
Urban land.					
103 Alambique	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
104*:					
Alambique	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
McGarvey	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
105*:					
Barnabe	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: small stones, slope, depth to rock.
Candlestick	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
106*:					
Barnabe	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: small stones, slope, depth to rock.
Rock outcrop.					
107 Botella	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, dusty.	Moderate: dusty.	Slight.
108*:					
Botella	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.

See footnote at end of table.

TABLE 3.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
108*: Urban land.					
109*: Candlestick	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Barnabe	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: small stones, slope, depth to rock.
110*: Candlestick	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kron	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.
Buriburi	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
111--- Candlestick Variant	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
112--- Candlestick Variant	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
113--- Fagan	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
114*: Francisquito	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Urban land.					
115--- Los Gatos	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
116--- Maymen	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, depth to rock.
117--- Novato	Severe: flooding, ponding, too clayey.	Severe: ponding, too clayey, excess salt.	Severe: too clayey, ponding, flooding.	Severe: ponding, too clayey.	Severe: excess salt, ponding, droughty.
118--- Novato	Severe: ponding, too clayey, excess salt.	Severe: ponding, too clayey, excess salt.	Severe: too clayey, ponding, excess salt.	Severe: ponding, too clayey.	Severe: excess salt, ponding, droughty.

See footnote at end of table.

TABLE 3.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
119--- Obispo	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Moderate: too clayey.	Severe: depth to rock, too clayey.
120--- Obispo	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: too clayey, slope.	Severe: slope, depth to rock, too clayey.
121, 122. Orthents					
123*, 124*: Orthents.					
Urban land.					
125*: Pits.					
Dumps.					
126--- Reyes	Severe: flooding, too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: droughty, too clayey.
127*: Rock outcrop.					
Orthents.					
128*: Scarper---	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Miramar---	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
129--- Sirdrak	Severe: slope, too sandy, soil blowing.	Severe: slope, too sandy, soil blowing.	Severe: slope, too sandy, soil blowing.	Severe: too sandy, slope, soil blowing.	Severe: slope.
130*: Typic Argiustolls.					
Urban land.					
131*. Urban land					
132*, 133*, 134*, 135*: Urban land.					
Orthents.					
136*: Urban land.					

See footnote at end of table.

TABLE 3.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
136*:					
Sirdrak	Severe: slope, too sandy, soil blowing.	Severe: slope, too sandy, soil blowing.	Severe: slope, too sandy, soil blowing.	Severe: too sandy, slope, soil blowing.	Severe: slope.
137*:					
Zeni	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Zeni Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 4.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
101*:						
Accelerator	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Fagan	Moderate: too clayey, slope.	Severe: shrink-swell.	Moderate: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
102*:						
Accelerator	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Fagan	Moderate: too clayey, slope.	Severe: shrink-swell.	Moderate: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
Urban land.						
103 Alambique	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
104*:						
Alambique	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
McGarvey	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
105*:						
Barnabe	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, depth to rock.
Candlestick	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
106*:						
Barnabe	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, depth to rock.
Rock outcrop.						
107 Botella	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
108*:						
Botella	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.

See footnote at end of table.

TABLE 4.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
108*: Urban land.						
109*: Candlestick	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Barnabe	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, depth to rock.
110*: Candlestick	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kron	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.
Buriburi	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
111--- Candlestick Variant	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
112--- Candlestick Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
113--- Fagan	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
114*: Francisquito	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope.
Urban land.						
115--- Los Gatos	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
116--- Maymen	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.
117--- Novato	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: low strength, ponding, flooding.	Severe: excess salt, ponding, droughty.

See footnote at end of table.

TABLE 4.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
118---------- Novato	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: excess salt, ponding, droughty.
119---------- Obispo	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, low strength.	Severe: depth to rock, too clayey.
120---------- Obispo	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, low strength, slope.	Severe: slope, depth to rock, too clayey.
121, 122. Orthents						
123*, 124*: Orthents.						
Urban land.						
125*: Pits.						
Dumps.						
126---------- Reyes	Moderate: too clayey, wetness.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Severe: droughty, too clayey.
127*: Rock outcrop.						
Orthents.						
128*: Scarper----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Miramar----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
129---------- Sirdrak	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
130*: Typic Argiustolls.						
Urban land.						
131*. Urban land						
132*, 133*, 134*, 135*: Urban land.						

See footnote at end of table.

TABLE 4.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
132*, 133*, 134*, 135*: Orthents.						
136*: Urban land.						
Sirdrak----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
137*:						
Zeni----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Zeni Variant-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 5.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoons	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
101*:					
Accelerator	Severe: percs slowly.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: depth to rock, slope, thin layer.
Fagan	Severe: percs slowly.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Poor: thin layer.
102*:					
Accelerator	Severe: percs slowly.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: depth to rock, slope, thin layer.
Fagan	Severe: percs slowly.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Poor: thin layer.
Urban land.					
103 Alambique	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
104*:					
Alambique	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
McGarvey	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: depth to rock, too clayey, hard to pack.
105*:					
Barnabe	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
Candlestick	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
106*:					
Barnabe	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
Rock outcrop.					

See footnotes at end of table.

TABLE 5.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoons	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
107 Botella	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
108*: Botella	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Urban land.					
109*: Candlestick	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
Barnabe	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
110*: Candlestick	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
Kron	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
Buriburi	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
111 Candlestick Variant	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
112 Candlestick Variant	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
113 Fagan	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope, thin layer.
114*: Francisquito	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Urban land.					
115 Los Gatos	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
116 Maymen	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.

See footnotes at end of table.

TABLE 5.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoons	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
117---------- Novato	Severe: flooding, ponding, percs slowly.	Severe: flooding**, ponding.	Severe: flooding, ponding, too clayey.	Severe: flooding, ponding.	Poor: too clayey, hard to pack, ponding.
118---------- Novato	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey, excess salt.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
119---------- Obispo	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey.
120---------- Obispo	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: depth to rock, too clayey, slope.
121, 122. Orthents					
123*, 124*: Orthents.					
Urban land.					
125*: Pits.					
Dumps.					
126---------- Reyes	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey, excess salt.	Severe: wetness.	Poor: too clayey, hard to pack, excess salt.
127*: Rock outcrop.					
Orthents.					
128*: Scarper----------	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, slope.
Miramar----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
129---------- Sirdrak	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
130*: Typic Argiustolls.					
Urban land.					

See footnotes at end of table.

TABLE 5.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoons	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
131*. Urban land					
132*, 133*, 134*, 135*: Urban land.					
Orthents.					
136*: Urban land.					
Sirdrak----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
137*: Zeni----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.
Zeni Variant-------	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, small stones, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.
** If floodwater will not enter or damage sewage lagoons (low velocity and depth less than 5 feet), disregard flooding.

TABLE 6.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "poor," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
101*:				
Accelerator	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, slope.
Fagan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
102*:				
Accelerator	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, slope.
Fagan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Urban land.				
103 Alambique	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
104*:				
Alambique	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
McGarvey	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
105*:				
Barnabe	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, slope.
Candlestick	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
106*:				
Barnabe	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, slope.
Rock outcrop.				
107 Botella	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 6.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
108*:				
Botella	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
Urban land.				
109*:				
Candlestick	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Barnabe	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, slope.
110*:				
Candlestick	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Kron	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Buriburi	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
111--- Candlestick Variant	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
112--- Candlestick Variant	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
113--- Fagan	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
114*:				
Francisquito	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer, slope.
Urban land.				
115--- Los Gatos	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
116--- Maymen	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, slope.
117--- Novato	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, wetness.

See footnote at end of table.

TABLE 6.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
118--- Novato	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, wetness.
119, 120--- Obispo	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey, small stones.
121, 122. Orthents				
123*, 124*: Orthents.				
Urban land.				
125*: Pits.				
Dumps.				
126--- Reyes	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt.
127*: Rock outcrop.				
Orthents.				
128*:				
Scarper---	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Miramar---	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
129--- Sirdrak	Poor: slope.	Probable---	Improbable: too sandy.	Poor: too sandy, slope.
130*: Typic Argiustolls.				
Urban land.				
131*. Urban land				
132*, 133*, 134*, 135*: Urban land.				
Orthents.				

See footnote at end of table.

TABLE 6.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
136*: Urban land.				
Sirdrak	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
137*:				
Zeni	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Zeni Variant	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--	
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation
101*:				
Accelerator	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.
Fagan	Severe: slope.	Moderate: thin layer.	Deep to water	Percs slowly, slope.
102*:				
Accelerator	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.
Fagan	Severe: slope.	Moderate: thin layer.	Deep to water	Percs slowly, slope.
Urban land.				
103--- Alambique	Severe: slope.	Severe: piping.	Deep to water	Slope, depth to rock.
104*:				
Alambique	Severe: slope.	Severe: piping.	Deep to water	Slope, depth to rock.
McGarvey	Severe: slope.	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly, depth to rock, slope.
105*:				
Barnabe	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, depth to rock, slope.
Candlestick	Severe: slope.	Severe: piping.	Deep to water	Depth to rock, slope.
106*:				
Barnabe	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, depth to rock, slope.
Rock outcrop.				
107--- Botella	Slight	Moderate: piping.	Deep to water	Erodes easily.
108*:				
Botella	Slight	Moderate: piping.	Deep to water	Favorable.
Urban land.				
109*:				
Candlestick	Severe: slope.	Severe: piping.	Deep to water	Depth to rock, slope.

See footnote at end of table.

TABLE 7.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--	
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation
109*: Barnabe	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, depth to rock, slope.
110*: Candlestick	Severe: slope.	Severe: piping.	Deep to water	Depth to rock, slope.
Kron	Severe: depth to rock, slope.	Severe: thin layer, piping.	Deep to water	Depth to rock, slope.
Buriburi	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Depth to rock, slope.
111, 112 Candlestick Variant	Severe: slope.	Moderate: piping.	Deep to water	Slope.
113 Fagan	Severe: slope.	Moderate: thin layer.	Deep to water	Percs slowly, slope.
114*: Francisquito	Severe: slope.	Moderate: hard to pack.	Deep to water	Slope, percs slowly, erodes easily.
Urban land.				
115 Los Gatos	Severe: slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.
116 Maymen	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, depth to rock, slope.
117 Novato	Slight	Severe: hard to pack, ponding, excess salt.	Ponding, percs slowly, flooding.	Ponding, droughty, slow intake.
118 Novato	Slight	Severe: hard to pack, ponding, excess salt.	Ponding, percs slowly, excess salt.	Ponding, droughty, slow intake.
119, 120 Obispo	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock.
121, 122. Orthents				
123*, 124*: Orthents.				
Urban land.				

See footnote at end of table.

TABLE 7.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--	
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation
125*: Pits. Dumps.				
126---------- Reyes	Slight----------	Severe: hard to pack, excess salt.	Deep to water----------	Droughty, slow intake, percs slowly.
127*: Rock outcrop. Orthents.				
128*: Scarper----------	Severe: seepage, slope.	Severe: seepage.	Deep to water----------	Droughty, depth to rock, slope.
Miramar----------	Severe: slope.	Severe: thin layer.	Deep to water----------	Slope, depth to rock, erodes easily.
129---------- Sirdrak	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water----------	Droughty, fast intake, soil blowing.
130*: Typic Argiustolls. Urban land.				
131*. Urban land				
132*, 133*, 134*, 135*: Urban land. Orthents.				
136*: Urban land.				
Sirdrak----------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water----------	Droughty, fast intake, soil blowing.
137*:				
Zeni----------	Severe: slope.	Severe: thin layer.	Deep to water----------	Depth to rock, slope.
Zeni Variant-----	Severe: slope.	Moderate: thin layer.	Deep to water----------	Droughty, depth to rock, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
101*:											
Accelerator-----	0-23	Loam----------	CL-ML, ML	A-4	0	90-100	85-100	75-85	50-75	25-35	5-10
	23-29	Sandy clay loam, clay loam, silty clay loam.	CL	A-6	0	90-100	85-100	80-95	50-85	30-40	10-20
	29-41	Gravelly clay loam.	CL, GC	A-6	0	65-80	60-75	55-65	40-60	30-40	10-20
	41	Weathered bedrock	---	---	---	---	---	---	---	---	---
Fagan-----------	0-5	Loam----------	CL, CL-ML	A-6, A-4	0	80-100	75-100	70-95	60-80	25-35	5-15
	5-26	Clay loam--------	CL	A-6, A-7	0	80-100	75-100	70-95	65-85	35-45	15-25
	26-43	Clay, silty clay	CL, CH	A-7	0	80-100	75-100	75-100	70-95	40-60	20-35
	43	Weathered bedrock	---	---	---	---	---	---	---	---	---
102*:											
Accelerator-----	0-23	Loam----------	CL-ML, ML	A-4	0	90-100	85-100	75-85	50-75	25-35	5-10
	23-29	Sandy clay loam, clay loam, silty clay loam.	CL	A-6	0	90-100	85-100	80-95	50-85	30-40	10-20
	29-41	Gravelly clay loam.	CL, GC	A-6	0	65-80	60-75	55-65	40-60	30-40	10-20
	41	Weathered bedrock	---	---	---	---	---	---	---	---	---
Fagan-----------	0-5	Loam----------	CL, CL-ML	A-6, A-4	0	80-100	75-100	70-95	60-80	25-35	5-15
	5-26	Clay loam--------	CL	A-6, A-7	0	80-100	75-100	70-95	65-85	35-45	15-25
	26-43	Clay, silty clay	CL, CH	A-7	0	80-100	75-100	75-100	70-95	40-60	20-35
	43	Weathered bedrock	---	---	---	---	---	---	---	---	---
Urban land.											
103----------	0-6	Sandy loam-------	SM	A-4	0	80-100	75-95	50-75	35-50	20-30	NP-5
Alambique	6-30	Loam----------	ML, CL-ML	A-4	0	80-100	75-95	60-80	50-60	25-35	5-10
	30	Weathered bedrock	---	---	---	---	---	---	---	---	---
104*:											
Alambique-------	0-12	Gravelly loam----	GM, GM-GC, SM, SM-SC	A-4	0	55-80	50-75	45-65	35-50	25-35	5-10
	12-30	Gravelly loam----	GM, GM-GC, SM, SM-SC	A-4	0	55-80	50-75	45-65	35-50	25-35	5-10
	30	Weathered bedrock	---	---	---	---	---	---	---	---	---
McGarvey--------	0-7	Loam----------	ML, CL-ML	A-4	0	85-95	80-90	65-75	50-70	25-35	5-10
	7-14	Clay loam--------	CL	A-6	0	90-100	90-100	75-85	65-80	30-40	10-20
	14-37	Clay loam, clay	CL, CH	A-7	0	90-100	90-100	85-95	75-85	40-55	20-30
	37	Weathered bedrock	---	---	---	---	---	---	---	---	---
105*:											
Barnabe---------	0-7	Very gravelly sandy loam.	GM, GM-GC	A-1, A-2	0	45-55	35-50	25-35	15-25	20-30	NP-10
	7-12	Very gravelly loam, very gravelly sandy loam.	GM-GC, GM	A-2	0	45-55	35-50	25-45	15-30	25-35	5-10
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 8.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
105*:											
Candlestick-----	0-2	Fine sandy loam	SM	A-4	0	90-100	85-100	65-75	35-50	20-30	NP-5
	2-20	Loam----------	ML	A-4	0	90-100	85-100	75-85	50-60	25-35	NP-10
	20-24	Sandy clay loam, clay loam.	SC, CL	A-6	0	80-95	75-95	70-85	35-60	30-40	10-20
	24	Unweathered bedrock.	GC, CL	A-6	0	55-80	50-75	45-70	35-55	30-40	10-20
106*:											
Barnabe---------	0-7	Very gravelly sandy loam.	GM, GM-GC	A-1, A-2	0	45-55	35-50	25-35	15-25	20-30	NP-10
	7-12	Very gravelly loam, very gravelly sandy loam.	GM-GC, GM	A-2	0	45-55	35-50	25-45	15-30	25-35	5-10
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
107----------	0-36	Loam----------	CL-ML, CL	A-4, A-6	0	80-100	75-100	65-95	50-70	25-35	5-15
Botella	36-60	Silty clay loam, clay loam.	CL	A-6, A-7	0	90-100	85-100	70-95	60-85	30-45	10-20
108*:											
Botella---------	0-17	Clay loam--------	CL	A-6	0	80-100	75-100	70-95	60-90	30-40	10-20
	17-60	Silty clay loam, clay loam.	CL	A-6, A-7	0	90-100	85-100	70-95	60-85	30-45	10-20
Urban land.											
109*:											
Candlestick-----	0-2	Fine sandy loam	SM	A-4	0	90-100	85-100	65-75	35-50	20-30	NP-5
	2-20	Loam----------	ML	A-4	0	90-100	85-100	75-85	50-60	25-35	NP-10
	20-24	Sandy clay loam, clay loam.	SC, CL	A-6	0	80-95	75-95	70-85	35-60	30-40	10-20
	24	Unweathered bedrock.	GC, CL	A-6	0	55-80	50-75	45-70	35-55	30-40	10-20
Barnabe---------	0-7	Very gravelly sandy loam.	GM, GM-GC	A-1, A-2	0	45-55	35-50	25-35	15-25	20-30	NP-10
	7-12	Very gravelly loam, very gravelly sandy loam.	GM-GC, GM	A-2	0	45-55	35-50	25-45	15-30	25-35	5-10
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
110*:											
Candlestick-----	0-2	Fine sandy loam	SM	A-4	0	90-100	85-100	65-75	35-50	20-30	NP-5
	2-20	Loam----------	ML	A-4	0	90-100	85-100	75-85	50-60	25-35	NP-10
	20-24	Sandy clay loam, clay loam.	SC, CL	A-6	0	80-95	75-95	70-85	35-60	30-40	10-20
	24	Unweathered bedrock.	GC, CL	A-6	0	55-80	50-75	45-70	35-55	30-40	10-20
Kron----------	0-3	Sandy loam-------	SM	A-4	0	90-100	85-100	50-75	35-50	20-30	NP-5
	3-14	Loam, very fine sandy loam.	ML	A-4	0	90-100	85-100	65-85	50-65	25-35	NP-10
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 8.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
110*:											
Buriburi--------	0-30	Gravelly loam----	GM, SM	A-4	0	55-80	50-75	45-70	35-50	25-35	NP-10
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
111, 112---------	0-21	Loam-------------	ML, CL-ML	A-4	0	90-100	85-100	75-95	50-75	25-35	5-10
Candlestick Variant	21-65	Clay loam--------	CL	A-6	0	90-100	85-100	80-90	65-80	30-40	10-20
113---------------	0-5	Loam-------------	CL, CL-ML	A-6, A-4	0	80-100	75-100	70-95	60-80	25-35	5-15
Fagan	5-26	Clay loam--------	CL	A-6, A-7	0	80-100	75-100	70-95	65-85	35-45	15-25
	26-43	Clay, silty clay	CL, CH	A-7	0	80-100	75-100	75-100	70-95	40-60	20-35
	43	Weathered bedrock	---	---	---	---	---	---	---	---	---
114*:											
Francisquito----	0-16	Loam-------------	ML, CL-ML	A-4	0	100	100	85-95	50-75	25-35	5-10
	16-26	Clay loam--------	CL	A-6	0	100	100	90-100	65-80	30-40	10-20
	26-50	Clay, clay loam	CL, CH	A-7	0	100	100	90-100	80-95	40-60	20-35
	50-60	Clay loam--------	CL	A-6	0	100	100	90-100	70-80	30-40	10-20
Urban land.											
115---------------	0-22	Loam-------------	CL-ML, ML	A-4	0-5	90-100	80-95	75-85	50-65	25-35	5-10
Los Gatos	22-36	Sandy clay loam	CL	A-6	0-5	75-95	75-95	60-80	50-65	30-40	10-20
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
116---------------	0-12	Gravelly loam----	SM, GM	A-2, A-4	0-5	60-80	50-75	30-60	25-50	20-35	NP-10
Maymen	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
117, 118---------	0-16	Clay-------------	MH	A-7	0	100	100	90-100	80-95	50-70	20-30
Novato	16-60	Clay, silty clay, silty clay loam.	MH	A-7	0	100	100	85-100	85-95	50-70	15-30
119, 120---------	0-12	Clay-------------	CL, CH	A-7	0-5	90-100	75-100	70-95	65-90	45-60	20-35
Obispo	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
121, 122. Orthents											
123*, 124*: Orthents.											
Urban land.											
125*: Pits.											
Dumps.											
126---------------	0-22	Clay-------------	MH	A-7	0	100	100	90-100	85-95	50-70	20-30
Reyes	22-60	Clay, silty clay	MH	A-7	0	100	100	85-100	85-95	50-70	15-30
127*: Rock outcrop.											
Orthents.											

See footnote at end of table.

TABLE 8.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
128*:											
Scarper	0-16	Gravelly coarse sandy loam.	SM	A-1, A-2	0	75-95	60-75	40-50	15-30	---	NP
	16-25	Gravelly coarse sandy loam.	SM	A-1, A-2	0	75-95	60-75	40-50	15-30	---	NP
	25	Weathered bedrock	---	---	---	---	---	---	---	---	---
Miramar	0-15	Loam	ML, CL-ML	A-4	0	90-100	85-100	80-90	55-70	25-35	5-10
	15-24	Clay loam, sandy clay loam.	CL	A-6	0	90-100	85-100	85-95	60-75	30-40	10-20
	24-29	Loam	ML, CL-ML	A-4	0	90-100	85-100	80-90	55-70	25-35	5-10
	29	Weathered bedrock	---	---	---	---	---	---	---	---	---
129	0-17	Sand	SP-SM, SM	A-2, A-3	0	100	100	50-80	5-25	---	NP
Sirdrak	17-60	Sand	SP-SM, SM	A-2, A-3	0	100	100	50-80	5-25	---	NP
130*:											
Typic Argiustolls.											
Urban land.											
131*.											
Urban land											
132*, 133*, 134*, 135*:											
Urban land.											
Orthents.											
136*:											
Urban land.											
Sirdrak	0-17	Sand	SP-SM, SM	A-2, A-3	0	100	100	50-80	5-25	---	NP
	17-60	Sand	SP-SM, SM	A-2, A-3	0	100	100	50-80	5-25	---	NP
137*:											
Zeni	0-9	Gravelly loam	SM, GM, SM-SC, GM-GC	A-4, A-2	0-5	55-80	50-75	40-65	30-50	25-35	5-10
	9-26	Gravelly clay loam.	GC, SC	A-6	0-5	55-80	50-75	45-70	35-50	30-40	10-20
	26	Weathered bedrock	---	---	---	---	---	---	---	---	---
Zeni Variant	0-13	Gravelly loam	SM, SM-SC, GM, GM-GC	A-4	0-5	65-80	60-75	55-70	35-50	25-35	5-10
	13-31	Very gravelly clay loam.	GC	A-6	5-20	55-65	50-60	45-55	35-50	30-40	10-15
	31-39	Gravelly clay loam.	CL	A-6	0-5	70-80	65-75	60-70	50-65	30-40	10-15
	39	Unweathered bedrock.	CL	A-6	0-5	70-80	65-75	60-70	50-65	30-40	10-15

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	In/hr	In/in	pH	mmhos/cm				Pct
101*:										
Accelerator-----	0-23	15-25	0.6-2.0	0.14-0.16	5.1-6.0	<2	Low----------	0.37	2	1-2
	23-29	25-35	0.2-0.6	0.17-0.19	5.1-6.0	<2	Moderate------	0.32		
	29-41	27-35	0.2-0.6	0.13-0.15	5.1-6.0	<2	Moderate------	0.20		
	41	---	---	---	---	---	----------	----		
Fagan-----------	0-5	20-27	0.6-2.0	0.15-0.17	5.6-7.3	<2	Moderate------	0.32	3	1-3
	5-26	35-40	0.2-0.6	0.17-0.19	5.6-7.3	<2	Moderate------	0.28		
	26-43	40-60	0.06-0.2	0.14-0.16	5.6-7.3	<2	High----------	0.28		
	43	---	---	---	---	---	----------	----		
102*:										
Accelerator-----	0-23	15-25	0.6-2.0	0.14-0.16	5.1-6.0	<2	Low----------	0.37	2	1-2
	23-29	25-35	0.2-0.6	0.17-0.19	5.1-6.0	<2	Moderate------	0.32		
	29-41	27-35	0.2-0.6	0.13-0.15	5.1-6.0	<2	Moderate------	0.20		
	41	---	---	---	---	---	----------	----		
Fagan-----------	0-5	20-27	0.6-2.0	0.15-0.17	5.6-7.3	<2	Moderate------	0.32	3	1-3
	5-26	35-40	0.2-0.6	0.17-0.19	5.6-7.3	<2	Moderate------	0.28		
	26-43	40-60	0.06-0.2	0.14-0.16	5.6-7.3	<2	High----------	0.28		
	43	---	---	---	---	---	----------	----		
Urban land.										
103----------	0-6	18-20	0.6-2.0	0.11-0.13	5.1-6.0	<2	Low----------	0.32	2	1-4
Alambique	6-30	18-25	0.6-2.0	0.13-0.16	5.1-6.0	<2	Low----------	0.32		
	30	---	---	---	---	---	----------	----		
104*:										
Alambique-------	0-12	15-25	0.6-2.0	0.09-0.13	5.1-6.0	<2	Low----------	0.20	2	1-4
	12-30	18-25	0.6-2.0	0.09-0.13	5.1-6.0	<2	Low----------	0.20		
	30	---	---	---	---	---	----------	----		
McGarvey--------	0-7	15-25	0.6-2.0	0.14-0.16	6.1-6.5	<2	Low----------	0.32	2	1-3
	7-14	27-35	0.2-0.6	0.17-0.19	6.6-7.3	<2	Moderate------	0.28		
	14-37	35-45	0.06-0.2	0.14-0.16	6.1-7.3	<2	High----------	0.24		
	37	---	---	---	---	---	----------	----		
105*:										
Barnabe---------	0-7	12-20	2.0-6.0	0.06-0.08	5.6-6.5	<2	Low----------	0.10	1	1-3
	7-12	15-27	0.6-2.0	0.07-0.10	5.6-6.5	<2	Low----------	0.15		
	12	---	---	---	---	---	----------	----		
Candlestick-----	0-2	15-20	0.6-2.0	0.12-0.14	5.6-6.5	<2	Low----------	0.32	2	1-3
	2-20	18-25	0.6-2.0	0.14-0.16	5.6-6.5	<2	Low----------	0.32		
	20-24	27-30	0.2-0.6	0.14-0.18	6.1-7.3	<2	Moderate------	0.28		
	24	---	---	---	---	---	----------	----		
106*:										
Barnabe---------	0-7	12-20	2.0-6.0	0.06-0.08	5.6-6.5	<2	Low----------	0.10	1	1-3
	7-12	15-27	0.6-2.0	0.07-0.10	5.6-6.5	<2	Low----------	0.15		
	12	---	---	---	---	---	----------	----		
Rock outcrop.										

See footnote at end of table.

TABLE 9.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	In/hr	In/in	pH	mmhos/cm				Pct
107----------	0-36	15-27	0.6-2.0	0.14-0.16	7.9-8.4	<2	Moderate------	0.37	5	2-6
Botella	36-60	30-35	0.2-0.6	0.16-0.19	7.9-8.4	<2	Moderate------	0.37		
108*:										
Botella---------	0-17	27-30	0.2-0.6	0.17-0.19	7.9-8.4	<2	Moderate------	0.32	5	2-6
	17-60	30-35	0.2-0.6	0.16-0.19	7.9-8.4	<2	Moderate------	0.37		
Urban land.										
109*:										
Candlestick-----	0-2	15-20	0.6-2.0	0.12-0.14	5.6-6.5	<2	Low----------	0.32	2	1-3
	2-20	18-25	0.6-2.0	0.14-0.16	5.6-6.5	<2	Low----------	0.32		
	20-24	27-30	0.2-0.6	0.14-0.18	6.1-7.3	<2	Moderate------	0.28		
	24	---	---	---	---	---	----------	----		
Barnabe---------	0-7	12-20	2.0-6.0	0.06-0.08	5.6-6.5	<2	Low----------	0.10	1	1-3
	7-12	15-27	0.6-2.0	0.07-0.10	5.6-6.5	<2	Low----------	0.15		
	12	---	---	---	---	---	----------	----		
110*:										
Candlestick-----	0-2	15-20	0.6-2.0	0.12-0.14	5.6-6.5	<2	Low----------	0.32	2	1-3
	2-20	18-25	0.6-2.0	0.14-0.16	5.6-6.5	<2	Low----------	0.32		
	20-24	27-30	0.2-0.6	0.14-0.18	6.1-7.3	<2	Moderate------	0.28		
	24	---	---	---	---	---	----------	----		
Kron----------	0-3	15-20	2.0-6.0	0.11-0.13	5.6-6.5	<2	Low----------	0.32	1	1-5
	3-14	15-20	0.6-2.0	0.14-0.16	5.6-6.5	<2	Low----------	0.37		
	14	---	---	---	---	---	----------	----		
Buriburi--------	0-30	18-27	0.6-2.0	0.10-0.14	5.6-6.5	<2	Low----------	0.20	2	1-3
	30	---	---	---	---	---	----------	----		
111, 112---------	0-21	18-27	0.6-2.0	0.12-0.15	5.6-6.0	<2	Low----------	0.32	5	1-3
Candlestick Variant	21-65	27-35	0.2-0.6	0.15-0.18	6.1-8.4	<2	Moderate------	0.32		
113----------	0-5	20-27	0.6-2.0	0.15-0.17	5.6-7.3	<2	Moderate------	0.32	3	1-3
Fagan	5-26	35-40	0.2-0.6	0.17-0.19	5.6-7.3	<2	Moderate------	0.28		
	26-43	40-60	0.06-0.2	0.14-0.16	5.6-7.3	<2	High----------	0.28		
	43	---	---	---	---	---	----------	----		
114*:										
Francisquito----	0-16	20-27	0.6-2.0	0.14-0.16	5.6-6.5	<2	Low----------	0.37	5	1-2
	16-26	27-35	0.2-0.6	0.17-0.19	5.6-6.5	<2	Moderate------	0.32		
	26-50	35-50	0.06-0.2	0.14-0.16	5.6-6.5	<2	High----------	0.28		
	50-60	27-35	0.2-0.6	0.17-0.19	5.6-6.0	<2	Moderate------	0.32		
Urban land.										
115----------	0-22	20-25	0.6-2.0	0.14-0.16	5.6-7.3	<2	Low----------	0.32	2	1-4
Los Gatos	22-36	25-35	0.2-0.6	0.14-0.20	5.6-7.3	<2	Moderate------	0.37		
	36	---	---	---	---	---	----------	----		
116----------	0-12	10-25	0.6-2.0	0.08-0.14	5.1-6.5	<2	Low----------	0.20	1	<1
Maymen	12	---	---	---	---	---	----------	----		
117----------	0-16	40-60	0.06-0.2	0.06-0.10	7.9-9.0	>8	High----------	0.20	5	4-10
Novato	16-60	35-60	0.06-0.2	0.03-0.05	7.9-9.0	>16	High----------	0.32		
118----------	0-16	40-60	0.06-0.2	0.06-0.10	7.9-9.0	>16	High----------	0.20	5	4-10
Novato	16-60	35-60	0.06-0.2	0.03-0.05	7.9-9.0	>16	High----------	0.32		

See footnote at end of table.

TABLE 9.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	In/hr	In/in	pH	mmhos/cm				Pct
119, 120--------- Obispo	0-12 12	40-60 ---	0.06-0.2 ---	0.13-0.15 ---	6.6-8.4 ---	<2 ---	Moderate------ ----------	0.24 ----	1	1-3
121, 122. Orthents										
123*, 124*: Orthents.										
Urban land.										
125*: Pits.										
Dumps.										
126-------------- Reyes	0-22 22-60	40-60 35-60	0.06-0.2 0.06-0.2	0.06-0.14 0.03-0.05	4.5-5.5 4.5-6.0	4-8 >16	High---------- High----------	0.20 0.32	5	2-10
127*: Rock outcrop.										
Orthents.										
128*: Scarper--------- 	0-16 16-25 25	8-18 8-18 ---	2.0-6.0 2.0-6.0 ---	0.07-0.09 0.07-0.09 ---	5.6-6.5 6.1-6.5 ---	<2 <2 ---	Low----------- Low----------- ----------	0.28 0.28 ----	3	1-3
Miramar--------- 	0-15 15-24 24-29 29	15-27 27-35 15-27 ---	0.6-2.0 0.2-0.6 0.6-2.0 ---	0.12-0.15 0.15-0.18 0.12-0.15 ---	6.1-7.3 6.1-6.5 6.1-6.5 ---	<2 <2 <2 ---	Low----------- Moderate------ Low----------- ----------	0.37 0.32 0.37 ----	2	1-3
129-------------- Sirdrak	0-17 17-60	0-5 0-5	6.0-20 6.0-20	0.05-0.07 0.05-0.07	5.1-6.5 5.1-6.5	<2 <2	Low----------- Low-----------	0.15 0.15	5	1-5
130*: Typic Argiustolls.										
Urban land.										
131*. Urban land										
132*, 133*, 134*, 135*: Urban land.										
Orthents.										
136*: Urban land.										
Sirdrak--------- 	0-17 17-60	0-5 0-5	6.0-20 6.0-20	0.05-0.07 0.05-0.07	5.1-6.5 5.1-6.5	<2 <2	Low----------- Low-----------	0.15 0.15	5	1-5

See footnote at end of table.

TABLE 9.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	In/hr	In/in	pH	mmhos/cm				Pct
137*:										
Zeni----------	0-9	15-27	0.6-2.0	0.10-0.15	5.1-6.5	<2	Low----------	0.20	2	1-4
	9-26	15-35	0.6-2.0	0.11-0.15	5.1-5.5	<2	Moderate------	0.20		
	26	---	---	---	---	---	----------	----		
Zeni Variant----	0-13	15-25	0.6-2.0	0.11-0.14	5.6-6.5	<2	Low----------	0.20	2	1-3
	13-31	30-35	0.2-0.6	0.06-0.12	5.1-6.0	<2	Moderate------	0.10		
	31-39	30-35	0.2-0.6	0.12-0.15	5.1-6.0	<2	Moderate------	0.20		
	39	---	---	---	---	---	----------	----		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Frequency of flooding	High water table			Bedrock		Risk of corrosion	
			Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
			Ft			In			
101*:									
Accelerator	B	None	>6.0	---	---	40-60	Soft	Moderate	Moderate.
Fagan	C	None	>6.0	---	---	40-60	Soft	Moderate	Moderate.
102*:									
Accelerator	B	None	>6.0	---	---	40-60	Soft	Moderate	Moderate.
Fagan	C	None	>6.0	---	---	40-60	Soft	Moderate	Moderate.
Urban land.									
103--- Alambique	B	None	>6.0	---	---	20-40	Soft	Moderate	Moderate.
104*:									
Alambique	B	None	>6.0	---	---	20-40	Soft	Moderate	Moderate.
McGarvey	C	None	>6.0	---	---	20-40	Soft	Moderate	Low.
105*:									
Barnabe	D	None	>6.0	---	---	8-20	Hard	Moderate	Moderate.
Candlestick	C	None	>6.0	---	---	20-40	Hard	Moderate	Moderate.
106*:									
Barnabe	D	None	>6.0	---	---	8-20	Hard	Moderate	Moderate.
Rock outcrop.									
107--- Botella	B	None	>6.0	---	---	>60	---	Moderate	Moderate.
108*:									
Botella	B	None	>6.0	---	---	>60	---	Moderate	Moderate.
Urban land.									
109*:									
Candlestick	C	None	>6.0	---	---	20-40	Hard	Moderate	Moderate.
Barnabe	D	None	>6.0	---	---	8-20	Hard	Moderate	Moderate.
110*:									
Candlestick	C	None	>6.0	---	---	20-40	Hard	Moderate	Moderate.
Kron	D	None	>6.0	---	---	10-20	Hard	Moderate	Moderate.
Buriburi	C	None	>6.0	---	---	20-40	Hard	Moderate	Moderate.
111, 112--- Candlestick Variant	B	None	>6.0	---	---	>60	---	Moderate	Moderate.
113--- Fagan	C	None	>6.0	---	---	40-60	Soft	Moderate	Moderate.

See footnote at end of table.

TABLE 10.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Frequency of flooding	High water table			Bedrock		Risk of corrosion	
			Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
			Ft			In			
114*: Francisquito-----	C	None----------	>6.0	---	---	>60	---	Moderate	Moderate.
Urban land.									
115---------- Los Gatos	C	None----------	>6.0	---	---	20-40	Hard	Moderate	Moderate.
116---------- Maymen	D	None----------	>6.0	---	---	10-20	Hard	High-----	High.
117---------- Novato	D	Frequent--------	+2-2.0	Apparent	Jan-Dec	>60	---	High-----	High.
118---------- Novato	D	None----------	+2-0	Perched	Jan-Dec	>60	---	High-----	High.
119, 120---------- Obispo	D	None----------	>6.0	---	---	8-20	Hard	Moderate	Low.
121, 122. Orthents									
123*, 124*: Orthents.									
Urban land.									
125*: Pits.									
Dumps.									
126---------- Reyes	D	Rare----------	3.0-5.0	Apparent	Jan-Dec	>60	---	High-----	High.
127*: Rock outcrop.									
Orthents.									
128*: Scarper----------	C	None----------	>6.0	---	---	20-40	Soft	Moderate	Moderate.
Miramar----------	B	None----------	>6.0	---	---	20-40	Soft	Moderate	Low.
129---------- Sirdrak	A	None----------	>6.0	---	---	>60	---	Moderate	Moderate.
130*: Typic Argiustolls.									
Urban land.									
131*. Urban land									
132*, 133*, 134*, 135*: Urban land.									

See footnote at end of table.

TABLE 10.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Frequency of flooding	High water table			Bedrock		Risk of corrosion	
			Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
			Ft			In			
132*, 133*, 134*, 135*: Orthents.									
136*: Urban land.									
Sirdrak----------	A	None----------	>6.0	---	---	>60	---	Moderate	Moderate.
137*:									
Zeni----------	C	None----------	>6.0	---	---	20-40	Hard	Moderate	Moderate.
Zeni Variant-----	C	None----------	>6.0	---	---	20-40	Hard	Moderate	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Accelerator	Fine-loamy, mixed, thermic Typic Haploxeralfs
Alambique*	Fine-loamy, mixed, isomesic Ustic Dystropepts
Barnabe	Loamy-skeletal, mixed, isomesic Lithic Haplustolls
Botella**	Fine-loamy, mixed, thermic Pachic Argixerolls
Buriburi	Fine-loamy, mixed, isomesic Pachic Haplustolls
Candlestick	Fine-loamy, mixed, isomesic Pachic Argiustolls
Candlestick Variant	Fine-loamy, mixed, isomesic Pachic Argiustolls
Fagan	Fine, montmorillonitic, thermic Typic Argixerolls
Francisquito	Fine, mixed, thermic Typic Haploxeralfs
Kron	Loamy, mixed, isomesic Lithic Haplustolls
Los Gatos	Fine-loamy, mixed, mesic Typic Argixerolls
Maymen	Loamy, mixed, mesic Dystric Lithic Xerochrepts
McGarvey	Fine, mixed, isomesic Ultic Tropudalfs
Miramar	Fine-loamy, mixed, isomesic Pachic Argiustolls
Novato	Fine, mixed, nonacid, isomesic Typic Hydraquents
Obispo	Clayey, serpentinitic, thermic Lithic Haploxerolls
Orthents	Orthents
Reyes	Fine, mixed, acid, thermic Sulfic Fluvaquents
Scarper	Coarse-loamy, mixed, isomesic Typic Haplustolls
Sirdrak**	Sandy, mixed, isomesic Ustic Dystropepts
Typic Argiustolls	Typic Argiustolls
Zeni**	Fine-loamy, mixed, isomesic Ultic Haplustalfs
Zeni Variant	Loamy-skeletal, mixed, isomesic Typic Argiustolls

* The soil in map unit 103 is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

** The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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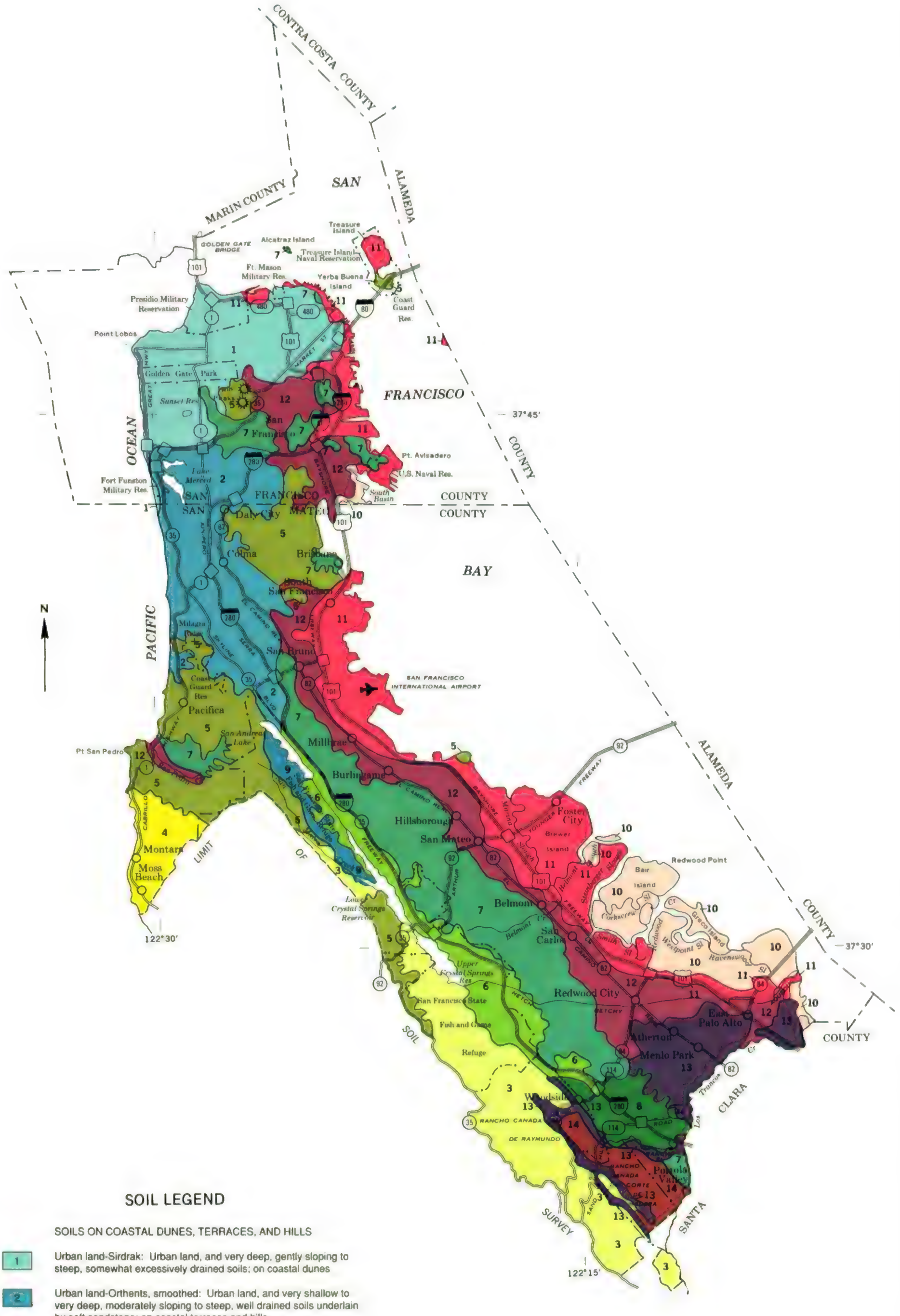


SOIL LEGEND

SOILS ON COASTAL DUNES, TERRACES, AND HILLS

1 — Urban land-Sirdrak: Urban land, and very deep, gently sloping to steep, somewhat excessively drained soils; on coastal dunes

2 — Urban land-Orthents, smoothed: Urban land, and very shallow to very deep, moderately sloping to steep, well drained soils underlain by soft sandstone; on coastal terraces and hills

SOILS ON UPLANDS

3 — Alambique-McGarvey: Moderately deep, moderately steep to very steep, well drained soils underlain by sandstone; on uplands

4 — Scarper-Miramar: Moderately deep, steep and very steep, well drained soils underlain by quartz-diorite; on uplands

5 — Barnabe-Candlestick-Buriburi: Very shallow to moderately deep, moderately steep to very steep, well drained soils underlain by sandstone; on uplands

6 — Fagan-Obispo: Shallow and deep, gently rolling to steep, well drained soils underlain by sandstone, shale, and serpentine; on uplands

Urban land-Orthents, cut and fill: Urban land, and very shallow to very deep, gently rolling to very steep, well drained soils underlain by sandstone; on uplands

Accelerator-Fagan-Urban land: Deep, gently rolling and rolling, well drained soils underlain by sandstone, shale, and siltstone, and Urban land; on uplands

Alambique-Zeni-Zeni Variant: Moderately deep, moderately steep to very steep, well drained soils underlain by sandstone and metasedimentary rock; on uplands

SOILS ON BOTTOM LANDS

10 — Novato-Reyes: Very deep, nearly level, very poorly drained and somewhat poorly drained soils; on tidal flats

Urban land-Orthents, reclaimed: Urban land, and very deep, nearly level, poorly drained and somewhat poorly drained soils; on reclaimed tidal flats

Urban land-Orthents: Urban land, and deep and very deep, nearly level and gently sloping, poorly drained to well drained soils; on alluvial fans, flood plains, and coastal terraces

Botella-Urban land: Very deep, nearly level and gently sloping, well drained soils, and Urban land; on alluvial fans, flood plains, and stream terraces

Francisquito-Urban land: Very deep, gently rolling and rolling, well drained soils, and Urban land; on terraces

Compiled 1990

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
(AGRICULTURAL EXPERIMENT STATION)

GENERAL SOIL MAP

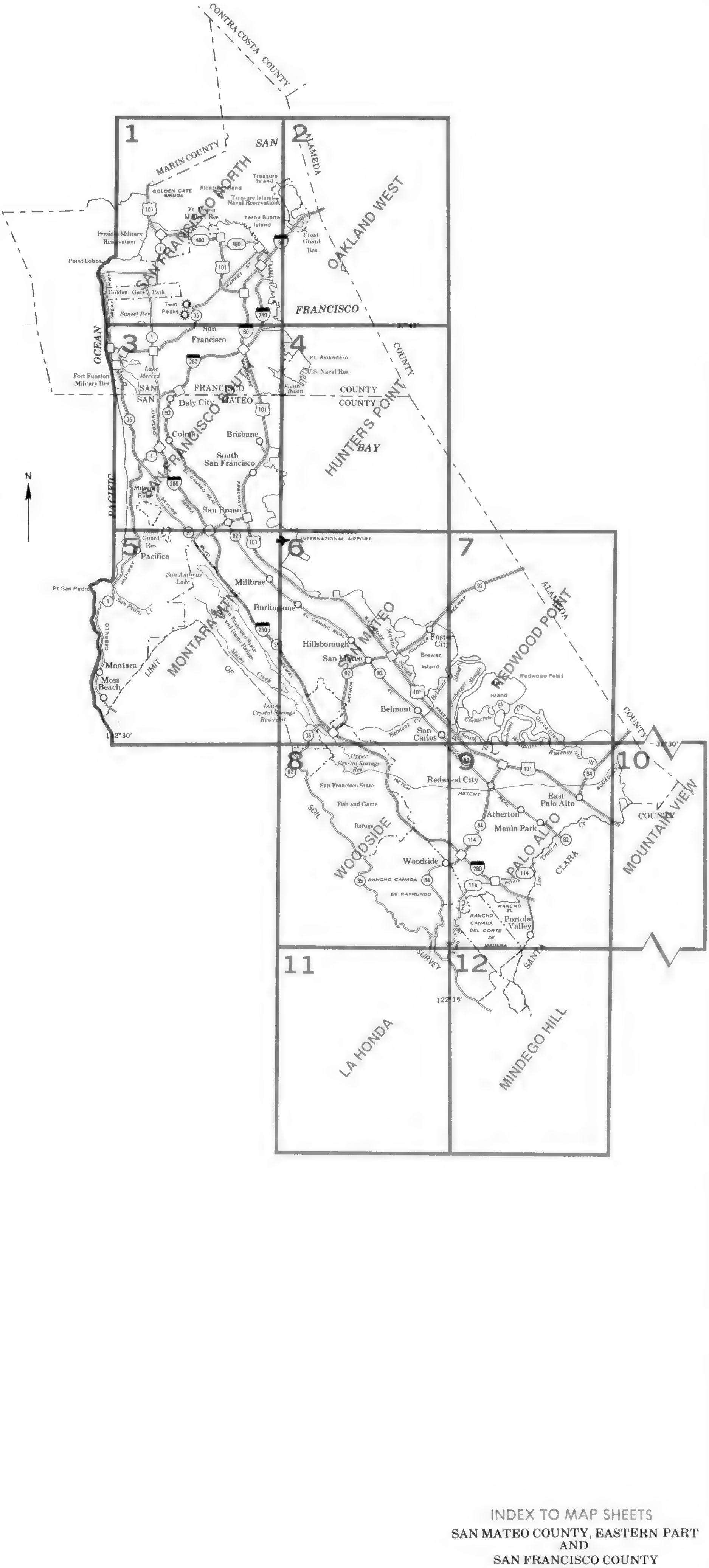
SAN MATEO COUNTY, EASTERN PART AND SAN FRANCISCO COUNTY CALIFORNIA

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



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SAN MATEO COUNTY, EASTERN PART AND SAN FRANCISCO COUNTY CALIFORNIA

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SAN MATEO COUNTY, EASTERN PART, AND
SAN FRANCISCO COUNTY, CALIFORNIA

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
(AGRICULTURAL EXPERIMENT STATION)

SOIL LEGEND

SYMBOL	NAME
101	Accelerator-Fagan association, 5 to 15 percent slopes
102	Accelerator-Fagan-Urban land complex, 5 to 15 percent slopes
103	Alambique sandy loam, 15 to 75 percent slopes
104	Alambique-McGarvey complex, 30 to 75 percent slopes
105	Barnabe-Candlestick complex, 30 to 75 percent slopes
106	Barnabe-Rock outcrop complex, 15 to 75 percent slopes
107	Botella loam, 0 to 5 percent slopes
108	Botella-Urban land complex, 0 to 5 percent slopes
109	Candlestick-Barnabe complex, 30 to 50 percent slopes
110	Candlestick-Kron-Bunbun complex, 30 to 75 percent slopes
111	Candlestick Variant loam, 2 to 15 percent slopes
112	Candlestick Variant loam, 15 to 30 percent slopes
113	Fagan loam, 15 to 50 percent slopes
114	Francisquito-Urban land complex, 5 to 15 percent slopes
115	Los Gatos loam, 30 to 75 percent slopes
116	Maymen gravelly loam, 30 to 50 percent slopes
117	Novato clay, 0 to 1 percent slopes
118	Novato clay, 0 to 1 percent slopes, ponded
119	Obispo clay, 5 to 15 percent slopes
120	Obispo clay, 15 to 30 percent slopes
121	Orthents, cut and fill, 0 to 15 percent slopes
122	Orthents, cut and fill, 15 to 75 percent slopes
123	Orthents, cut and fill-Urban land complex, 0 to 5 percent slopes
124	Orthents, cut and fill-Urban land complex, 5 to 75 percent slopes
125	Pits and Dumps
126	Reyes clay, 0 to 1 percent slopes
127	Rock outcrop-Orthents complex, 30 to 75 percent slopes
128	Scarper-Miramar complex, 30 to 75 percent slopes
129	Sirdrak sand, 5 to 50 percent slopes
130	Typic Argiustolls, loamy-Urban land association, 5 to 15 percent slopes
131	Urban land
132	Urban land-Orthents, cut and fill complex, 0 to 5 percent slopes
133	Urban land-Orthents, cut and fill complex, 5 to 75 percent slopes
134	Urban land-Orthents, reclaimed complex, 0 to 2 percent slopes
135	Urban land-Orthents, smoothed complex, 5 to 50 percent slopes
136	Urban land-Sirdrak complex, 2 to 50 percent slopes
137	Zeni-Zeni Variant gravelly loams, 30 to 75 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline
- AD HOC BOUNDARY (label)
- Small airport, airfield, park, oilfield, cemetery, or flood pool
- STATE COORDINATE TICK
- LAND DIVISION CORNER (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label)
- Located object (label)
- Tank (label)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
- Double-line (label)
- Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial
- Intermittent

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

- SOIL DELINEATIONS AND SYMBOLS
- ESCARPMENTS
  - Bedrock (points down slope)
  - Other than bedrock (points down slope)
- SHORT STEEP SLOPE
- GULLY
- DEPRESSION OR SINK
- SOIL SAMPLE (normally not shown)
- MISCELLANEOUS
  - Blowout
  - Clay spot
  - Gravelly spot
  - Gumbo, slick or scabby spot (sodic)
  - Dumps and other similar non soil areas
  - Prominent hill or peak
  - Rock outcrop (includes sandstone and shale)
  - Saline spot
  - Sandy spot
  - Severely eroded spot
  - Slide or slip (tips point upslope)
  - Stony spot, very stony spot
  - Beaches (less than 1/2 acre)

SOIL SURVEY OF SAN MATEO COUNTY, EASTERN PART, AND SAN FRANCISCO COUNTY, CALIFORNIA

(SAN FRANCISCO NORTH QUADRANGLE)

This soil survey was conducted by the U.S. Department of Agriculture, Soil Conservation Service, cooperating agencies. Base maps are photomosaics prepared by the U.S. Department of the Interior Geological Survey, from 1960 aerial photographs. Coordinate grid ticks and land line corners shown are approximately positioned.

1:24,000

SAN MATEO E., PART OF, AND SAN FRANCISCO N., CALIFORNIA

SOIL SURVEY OF SAN MATEO COUNTY, EASTERN PART, AND SAN FRANCISCO COUNTY, CALIFORNIA

(OAKLAND WEST QUADRANGLE)

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1970 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned

5000 4000 3000 2000 1000 0 1000 10000 Feet
1 .5 0 1 3 Kilometers
Scale - 1:24000

N

SAN MATEO E. PART & SAN FRANCISCO, CALIFOR NIA NO. 2

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1970 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

5000 4000 3000 2000 1000 0 5000 10000 feet
1 .5 0 1 2 3 Kilometers
Scale - 1:24000

SAN MATEO E. PART & SAN FRANCISCO, CALIFORNIA NO. 3

1 460 000 FEET

(Joins sheet 2)

134

134

134

124

131

134

134

RESERVATION

Hunters Point

U.S. NAVAL

ALAMEDA CO.

SAN FRANCISCO CITY AND CO.

ALAMEDA CO.

134

SAN FRANCISCO CITY AND CO.
SAN MATEO CO.

S A N F R A N C I S C O

B A Y

(Joins sheet 3)

134

134

SAN FRANCISCO
INTERNATIONAL AIRPORT

(Joins sheet 6)

4 470 000 FEET

1 490 000 FEET

5,000 4,000 3,000 2,000 1,000 0 5,000 10,000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24000

N

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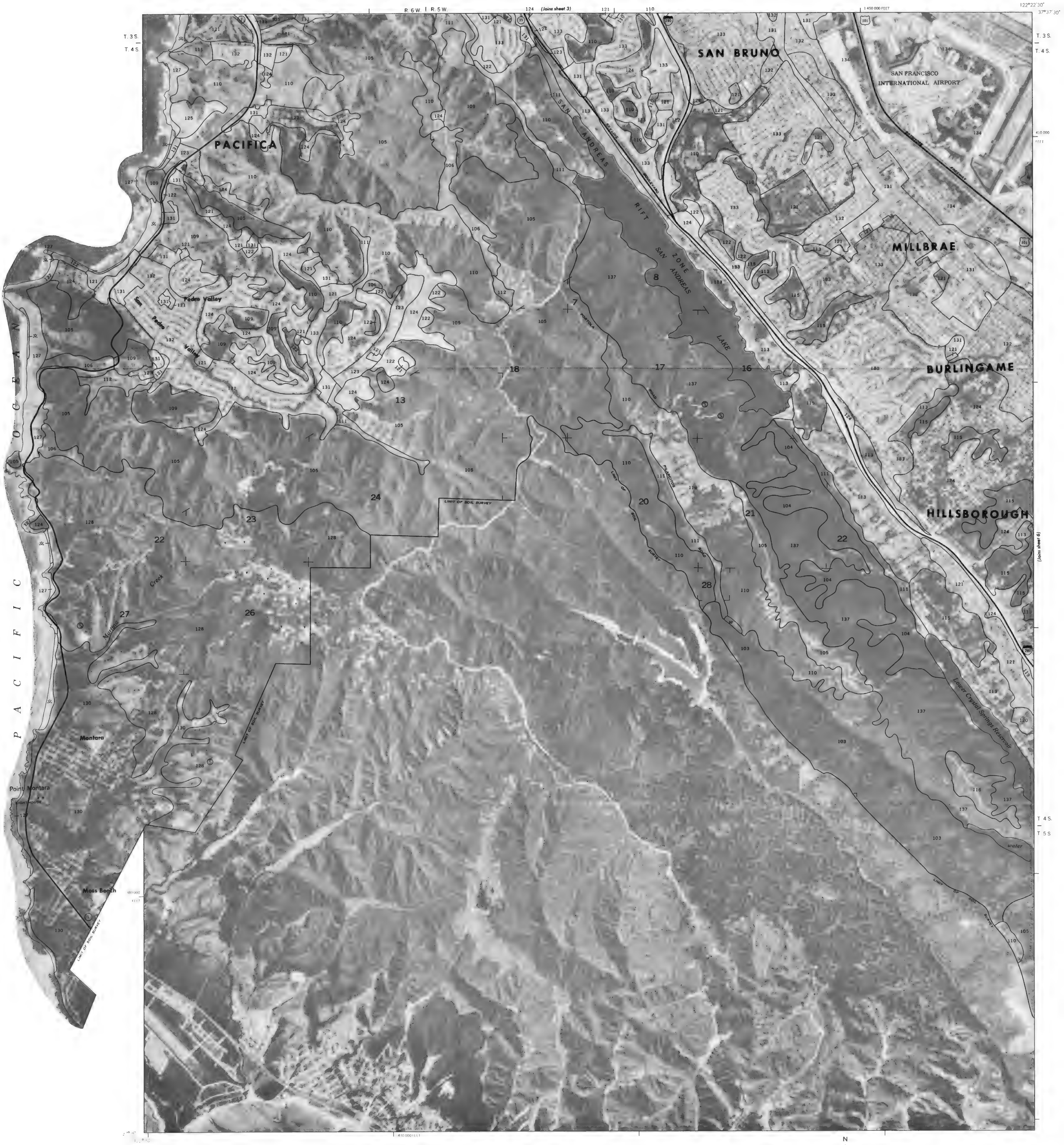
SAN MATEO E. PART & SAN FRANCISCO, CALIFORNIA NO. 4



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SAN MATEO E. PART & SAN FRANCISCO, CALIFORNIA NO. 5

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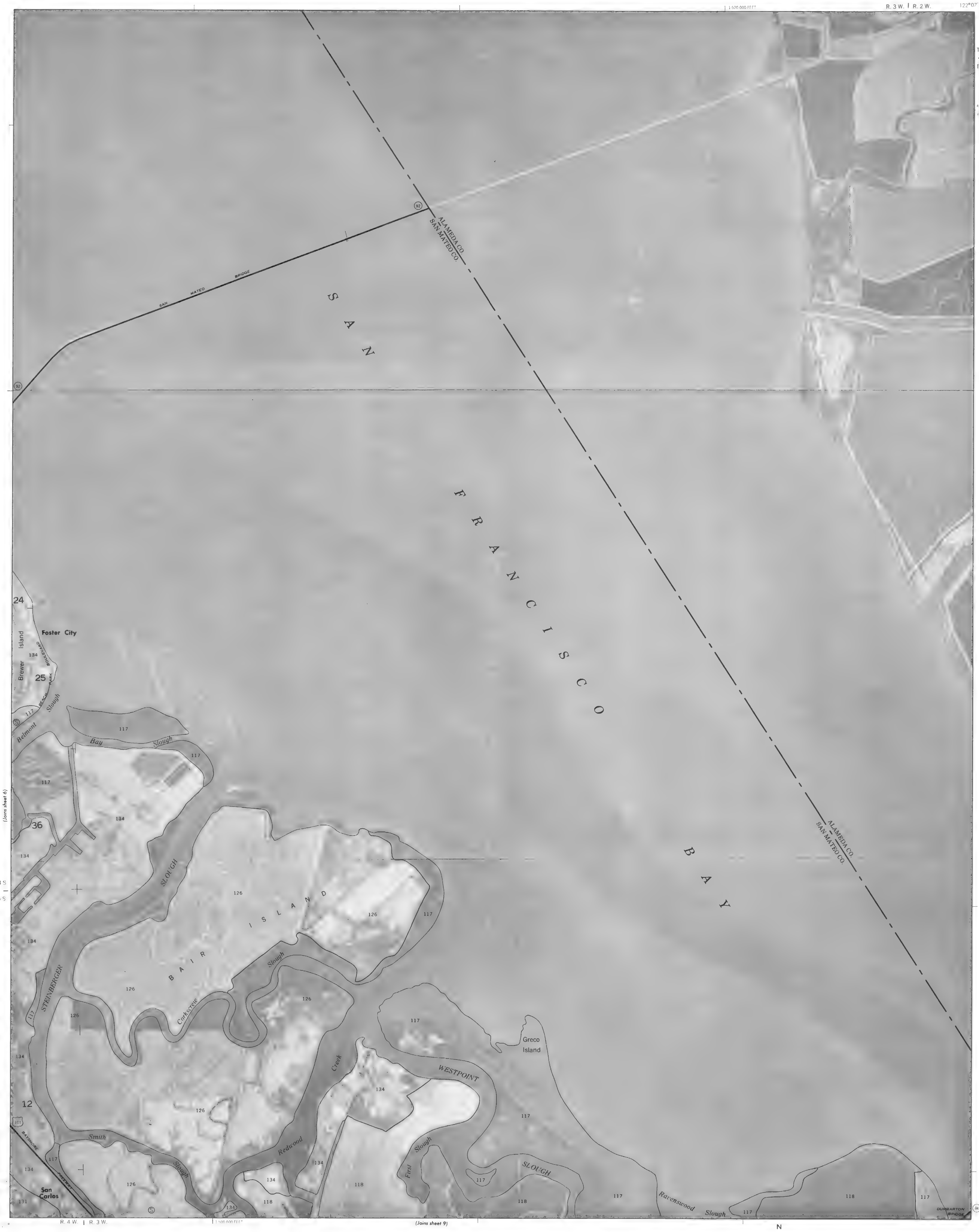
5000 4000 3000 2000 1000 0 5000 10000 Feet
1 .5 0 1 2 3 Kilometers
Scale · 1:24000

N

SAN MATEO E. PART & SAN FRANCISCO, CALIFOR NIA NO. 6

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NUMBER 7
SOIL SURVEY OF SAN MATEO COUNTY, EASTERN PART, AND SAN FRANCISCO COUNTY, CALIFORNIA
(REDWOOD POINT QUADRANGLE)



N

5000 4000 3000 2000 1000 0 5000 10 000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1970 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SAN MATEO E. PART & SAN FRANCISCO, CALIFORNIA NO. 7

R 5 W | R 4 W

(Joins sheet 6)

T 5 S
T 6 S

(Joins sheet 9)

(Joins sheet 11)

UPPER CRYSTAL SPRINGS RESERVOIR
CANADA ROAD
SAN ANDREAS RIFT ZONE
EDGEWOOD ROAD
SKYLINE BOULEVARD
KINGS MOUNTAIN ROAD
WOODSIDE ROAD
LIMIT OF SOIL SURVEY
San Carlos
Upper Emerald Lake
REDWOOD CITY
Woodside

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Scale - 1:24000

N

SAN MATEO E. PART & SAN FRANCISCO, CALIFOR NIA NO. 8

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NUMBER 9
SOIL SURVEY OF SAN MATEO COUNTY, EASTERN PART, AND SAN FRANCISCO COUNTY, CALIFORNIA
(PALO ALTO QUADRANGLE)

122°07'30"
37°30'

R. 4 W. | R. 3 W.

(Joins sheet 7)

1,520,000 FEET

San Carlos

REDWOOD CITY

ALTHERTON

MENLO PARK

East Palo Alto

Woodside

Portola Valley

Redwood Creek

Westpoint Slough

Ravenswood Slough

San Francisquito Creek

San Francisco Bay

BAYSHORE FREEWAY

SOUTHERN PACIFIC

WOODSIDE ROAD

SAN MATEO CO. — SANTA CLARA CO.

SAN ANDREAS RIFT ZONE

water

360,000 FEET

(Joins sheet 10)

T. 5 S.
—
T. 6 S.

(Joins sheet 8)

330,000 FEET

37°22'30"
122°15'

R. 4 W. | R. 3 W.

(Joins sheet 12)

1,500,000 FEET

R. 3 W. | R. 2 W.

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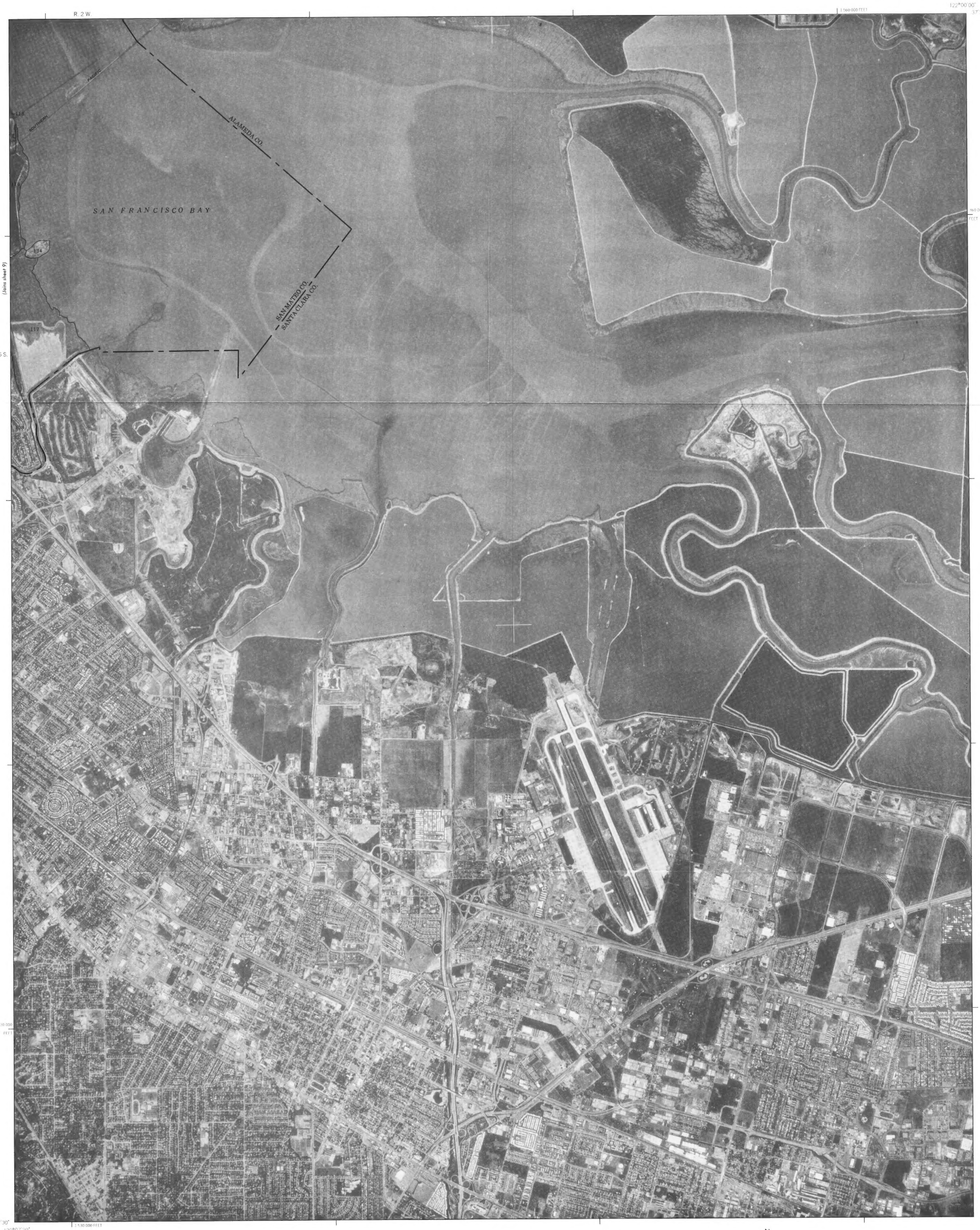
5000 4000 3000 2000 1000 0 5000 10000 Feet
1 .5 0 1 2 3 Kilometers
Scale - 1:24000

N

SAN MATEO E. PART & SAN FRANCISCO, CALIFOR NIA NO. 9



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1970 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

5000 4000 3000 2000 1000 0 5000 10000 Feet
1 .5 0 1 2 3 Kilometers
Scale - 1:24000

N

SAN MATEO E. PART & SAN FRANCISCO, CALIFOR NIA NO. 10

SOIL SURVEY OF SAN MATEO COUNTY, EASTERN PART, AND SAN FRANCISCO COUNTY, CALIFORNIA

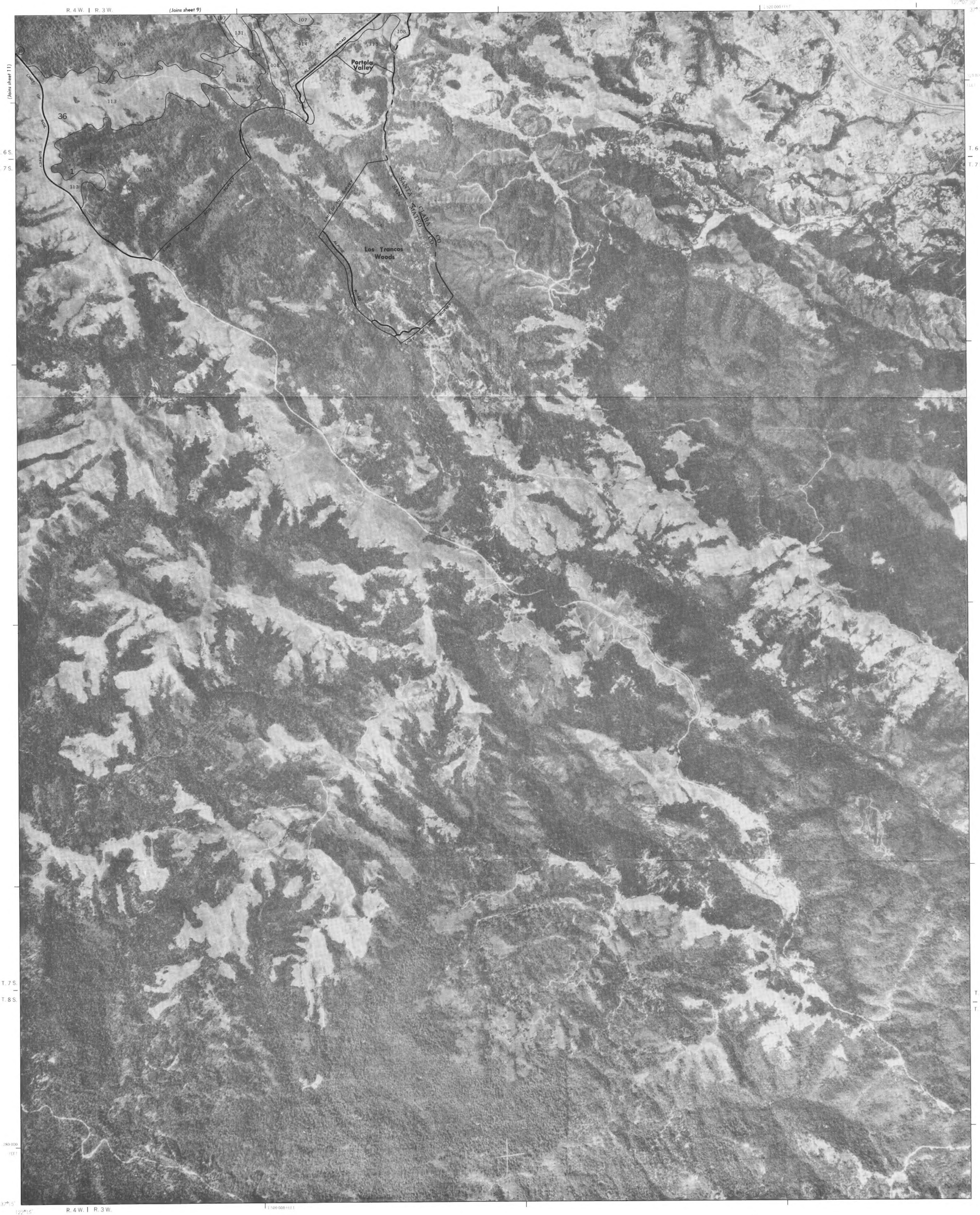
(LAHONDA QUADRANGLE)

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1970 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SAN MATEO E., PART & SAN FRANCISCO, CALIFOR NIA NO. 11

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NUMBER 12
SOIL SURVEY OF SAN MATEO COUNTY, EASTERN PART, AND SAN FRANCISCO COUNTY, CALIFORNIA
(MINDEGO HILL QUADRANGLE)



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1970 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

5000 4000 3000 2000 1000 0 5000 10000 Feet
1 .5 0 1 2 3 Kilometers
Scale - 1:24 000

N

SAN MATEO E. PART & SAN FRANCISCO, CALIFOR NIA NO. 12